US Army Corps of Engineers®
Savannah District

Glades Reservoir Draft Environmental Impact Statement

Chapter 3

Affected Environment

October 2015

3 AFFECTED ENVIRONMENT

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3 AFFECTED ENVIRONMENT

3.1 Introduction

In compliance with Council on Environmental Quality (CEQ) regulations 40 Code of Federal Regulations (CFR) 1502.15 established as part of the National Environmental Policy Act of 1969 (NEPA), this chapter describes the existing conditions of the biological, physical, and socioeconomic resources that may be affected by implementation of the proposed Glades Reservoir project, (Hall County's [Applicant's] Proposed Project) and the 12 alternatives carried forward to be analyzed in detail (see Chapter 2 Alternatives Analysis).

This chapter begins with a general description of the regional setting and areas affected by the key water supply components (Lake Sidney Lanier [Lake Lanier] allocation, new reservoir, and the transmission methods/systems to deliver water to and from the reservoir) for the Proposed Project and the alternatives carried forward for further evaluation (Section 3.2). Sections 3.3 through 3.13 contain descriptions of the affected area organized by specific resources.

The affected environment is characterized for the following resources:

- Water Resources
- Soils and Geology
- Land Use
- Climate Change and Greenhouse Gas
- Biological Resources
- Socioeconomic Conditions
- Visual and Aesthetic Resources
- Air Quality
- Noise
- Cultural Resources
- Hazardous Materials

The resource descriptions provide the basis upon which environmental impacts are analyzed in Chapter 4, Environmental Consequences. The descriptions focus on areas affected by key water supply components only (Lake Lanier allocation, new reservoirs, and the transmission methods/systems to deliver water to and from each of the alternative reservoir locations); water supply components common to each alternative (discussed in Chapter 2 and its appendices), such as additional water conservation measures, development of additional groundwater supply sources, water purchase from an adjacent county, and the use of Cedar Creek Reservoir, will not result in different environmental consequences among alternatives and are not the focus of this analysis.

Where possible, environmental setting characterizations are site-specific, such as the description of wetland resources at different reservoir locations. Otherwise, descriptions apply to all alternatives, such as climatology.

3.2 Regional Setting and Major Infrastructure Components

The affected area for the Proposed Project and alternatives is in three counties approximately 70 miles northeast of Atlanta, Georgia. The majority of the water supply infrastructure components comprising the Proposed Project and its alternatives are located in Hall County; some alternatives have components that are located in White County and Habersham County, which are adjacent counties located just north of Hall County.

All of the water supply infrastructure components for the Proposed Project and alternatives carried forward for further consideration are located in the Upper Chattahoochee River Basin. Specifically, these water supply components are located upstream of Lake Lanier and may have potential downstream impacts. The alternatives carried forward for further evaluation may affect flows through Lake Lanier, but there would be no new impacts on wetlands and streams since none of the Environmental Impact Statement (EIS) alternatives propose changes in Corps' reservoir operations, as presented in Section 3.3, Water Resources.

Water supply withdrawal from Lake Lanier is a major component within each alternative; the quantity of future water supply allocation from Lake Lanier plays an important part in determining the timing and the need of other potential water supply components (such as construction of a new reservoir).

As discussed in Chapter 1, the U.S. Army Corps of Engineers (Corps) Mobile District is in the process of updating its water control manual (WCM) for the Apalachicola-Chattahoochee-Flint (ACF) River Basin, and the environmental consequences of proposed operational changes in the ACF River Basin are currently being evaluated in the EIS for the ACF River Basin WCM update. Therefore, the discussions of existing conditions (this chapter) and potential environmental consequences and downstream impacts in Chapter 4 are limited to and solely based on the current operational rules in the existing WCM.

The major water supply infrastructure components for the alternatives carried forward to be analyzed in detail are summarized in **Table 3.1**.

Table 3.1 Summary of Water Supply Infrastructure Components of the Alternatives Carried Forward to be Analyzed in Detail

Alternative #	Alternative ID	Lake Lanier Allocation (mgd)	Reservoir Site	Reservoir Safe Yield (mgd)	River Water Transmission System (to reservoir)	Reservoir Water Transmission System (to Lakeside WTP)	Reservoir Water Transmission System (to New WTP)
Applicant's	L18-G50-PT	18	Glades	50	X		
1	L18-G42-PT	18	Glades	42	X		
2	L18-G42-PL	18		42	X	X	
3	L18-G42-WTP	18		42	X		X
4	L30-G30-PT	30		30	X		
5	L30-G30-PL	30		30	X	X	
6	L30-G30-WTP	30		30	X		X
7	L43-G17-PT	43		17	X		
8	L43-G17-PL	43		17	X	X	
9	L43-G17-WTP	43		17	X		X
10	L43-W17-PT	43	White	17	X		
11	L43-W17-PL	43		17	X	X	
No Action	L60	60	None				

Notes:
mgd = million gallons per day
WTP = Water Treatment Plant

Alternative Key for Major Water Supply Components:

<u>Lake Lanier</u>
L= Lake Lanier, the number following L indicates potential total water supply allocation for Hall County (including Gainesville)
18/30/43/60 = total annual average water supply withdrawal from Lake Lanier (mgd)

<u>Reservoir Site</u>
G = Glades Reservoir; W= White Creek Reservoir
42/30/17 = Reservoir safe yield = 42/30/17 mgd

<u>Transmission of Reservoir Raw Water</u>
PT = Release raw water to creek and "pass-through" flows to Lake Lanier for withdrawal
PL = Pump/pipeline for raw water from reservoir to Lakeside WTP
WTP = Construct a new WTP at Glades Reservoir site

<u>Other Components</u>
All feasible alternatives considered include the following common components: additional water conservation of 2.3 mgd, water purchase from Jackson County of 1.2 mgd, additional groundwater development in the County for a total of 4.7 mgd, and the use of Cedar Creek Reservoir (revised safe yield of 4.3 mgd). All quantities shown are annual average basis.

3.3 Water Resources

The following sections describe the existing conditions of potentially affected water resources, including surface water hydrology, ACF River Basin water management, surface water quality, floodplains, and groundwater.

3.3.1 Surface Water Hydrology

Surface water hydrology in the ACF River Basin is presented below through examination of flow rates, flow durations, reservoir water levels, and withdrawals. Factors affecting these conditions include climate conditions (Section 3.6), municipal and industrial consumption, agricultural use for irrigation, withdrawals for cooling water use at thermoelectric power plants, reservoir operations for hydropower generation, and flood risk management. This section begins with an overview of existing streamflows in the ACF River Basin, and then presents more detailed information in the vicinity of the water supply infrastructure needed for the alternatives carried forward to be analyzed in detail.

The Proposed Project and its alternatives (Glades and White Creek Reservoirs) are located upstream of Lake Lanier in the ACF River Basin (**Figure 3.1**); desk-top analysis and hydrological modeling are performed to evaluate the pumped-storage operations and the potential downstream impacts. Hydrological modeling performed for preliminary screening of alternatives (Chapter 2) shows that these potential impacts are much less significant downstream of Lake Lanier. Therefore, more hydrologic information is presented for the Upper Chattahoochee River Basin based on the magnitude of anticipated effects and on public scoping comments.

3.3.1.1 ACF River Basin

The ACF River Basin consists of three main rivers, the Chattahoochee River and the Flint River, which join to form the Apalachicola River (**Figure 3.1**) near the Georgia-Florida state line. The ACF River Basin crosses 60 counties in Georgia, 10 counties in Alabama, and 8 counties in Florida, extending a distance of approximately 385 miles. The basin has a total drainage area of approximately 19,600 square miles (sq mi). The Chattahoochee River has a drainage area of 8,770 sq mi and the Flint River drains an area of 8,460 sq mi. The remaining 2,440 sq mi of the ACF River Basin drain directly into the Apalachicola River.

Figure 3.1 ACF River Basin, Proposed Project Area, and U.S. Geological Survey (USGS) Streamflow Gages

Table 3.2 presents: 1) the drainage areas above the dam at Glades (Flat Creek) Reservoir and White Creek Reservoir, and 2) the drainage area above the raw water intake on the Chattahoochee River for each dam and reservoir. The drainage area at the proposed river intake is less than 2 percent (%) of the total ACF River Basin drainage area. The Flat Creek watershed above the dam is less than 0.1% of the total drainage area of the entire ACF River Basin. The White Creek watershed above the dam is approximately 0.05% of the total drainage area of the entire ACF River Basin.

Table 3.2 Drainage Areas of Potential Reservoir Sites and River Raw Water Intakes (sq mi)

Drainage Area	Flat Creek (Glades)	White Creek
Above Proposed Dam	17.6	10.2
Above Proposed Chattahoochee River Raw Water Intake	374.0	318.0

Chattahoochee River

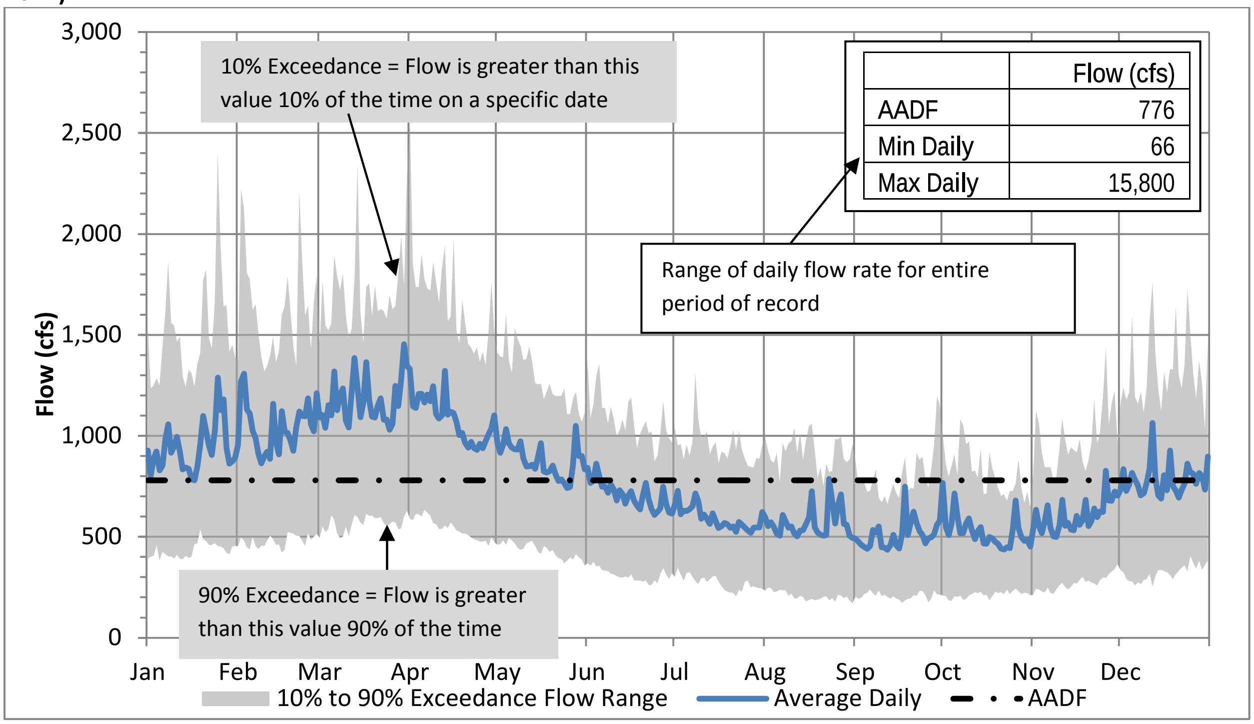
The Chattahoochee River originates in the Blue Ridge Mountains of north Georgia, near the westernmost tip of South Carolina, and extends to the southwest corner of the state. The river flows out of the mountains, past metropolitan Atlanta, and reaches the Georgia-Alabama border, at which point it forms the border between the two states. From there, the Chattahoochee River flows south to its confluence with the Flint River at Lake Seminole and into the Apalachicola River. It covers a distance of 434 miles from the Blue Ridge Mountains to Lake Seminole.

> **Lake Lanier** provides 65% of total conservation storage capacity available in the ACF River Basin for flow regulation. However, it only controls runoff from 5.3 % of the basin's total drainage area.

The Chattahoochee River is free-flowing only in the headwaters upstream of Lake Lanier. Downstream of Lake Lanier, the river is affected by dam and reservoir operations. Over most of its length, the Chattahoochee River is controlled by dams (with navigation locks and hydroelectric plants) that provide for navigational use of the river, release water for the production of hydroelectric power generation, temporarily store water for flood reduction, and to serve other purposes. Many of the dams and hydroelectric plants operate in a peaking mode, which can result in daily water level fluctuations in the river of 4 feet or more (Couch et al., 1996). Peaking hydroelectric power generation projects typically generate power during the peak electrical demand hours (usually for 2 to 8 hours per day) on the weekdays but do not generate on the weekends. Storage for flood control at several of the larger reservoirs reduces the peak flow in the river by storing much of the flood flow.

High streamflows typically occur during the rainy season in the late winter/early spring months of February to April. Through late spring and summer, lower precipitation and high evapotranspiration combine to reduce river flows. The lowest monthly flows typically occur at the end of the summer in September. **Figure 3.1** shows the locations of key USGS streamflow gages analyzed for annual average daily flow (AADF), minimum daily flow, and maximum daily flow for the period of record available for each gage. These results are also tabulated in **Figure 3.2** through **Figure 3.5,** along with the average flow for each day of the year over the period of record and the 10% to 90% exceedance flow range[1] at the USGS gages at Cornelia, Atlanta, Whitesburg, and Columbus on the Chattahoochee River.

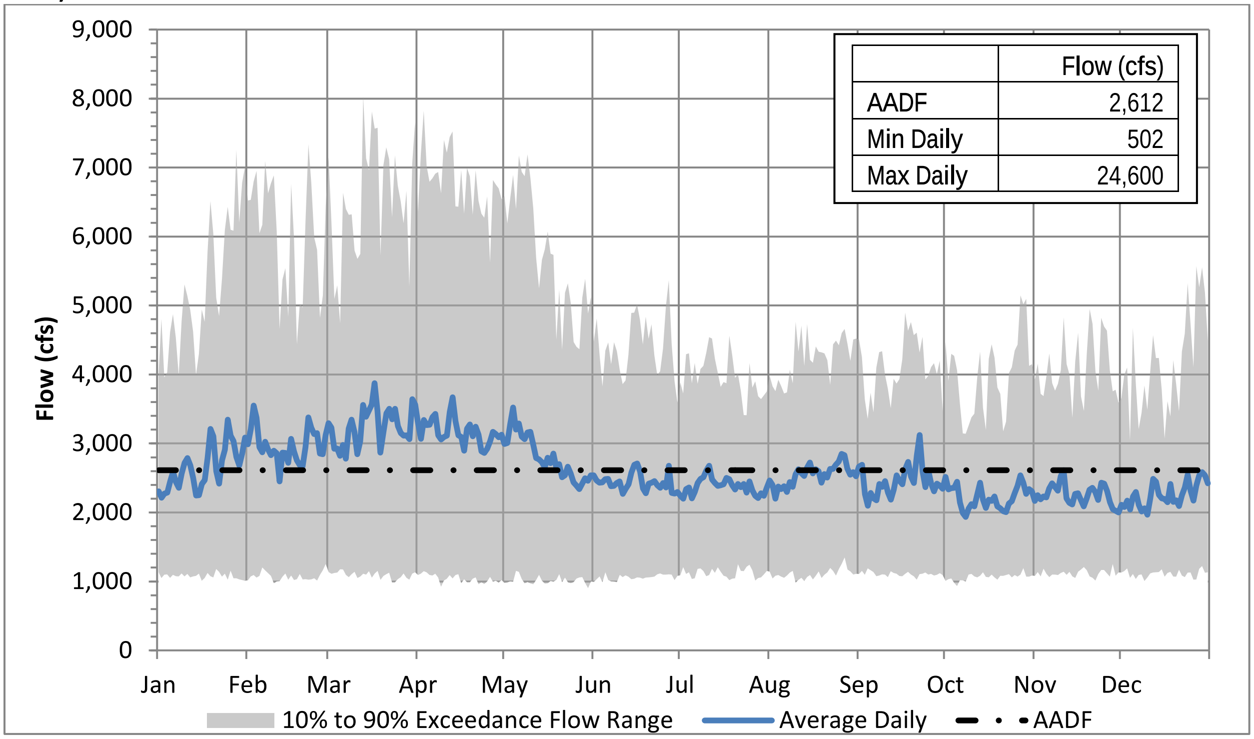
Figure 3.2 Chattahoochee River Average Daily Discharge (cfs) at USGS Gage 02331600 at Cornelia, GA (1958–2012)[1]



Notes:
cfs = cubic feet per second
[1] Labels explaining 10% and 90% exceedance range and the minimum and maximum range table are shown on this figure as a reference for remaining existing average daily flow condition figures in this chapter.

[1] The 10% to 90% exceedance flow range represents the majority of the flow records. 10% Exceedance is statistically calculated as the flow value on a day that has been exceeded 10% of the time. 90% Exceedance is the flow value that has been statistically exceeded 90% of the time.

Figure 3.3 Chattahoochee River Average Daily Discharge (cfs) at USGS Gage 02336000 at Atlanta, GA (1958–2012)[1]



[1] Record at USGS gage 02336000 starts on 8/1/1928. This figure shows flow at the Atlanta gage after Lake Lanier was built upstream and in operation (1958–2012).

Figure 3.4 Chattahoochee River Average Daily Discharge at USGS Gage 02338000 at Whitesburg, GA (1965–2012)

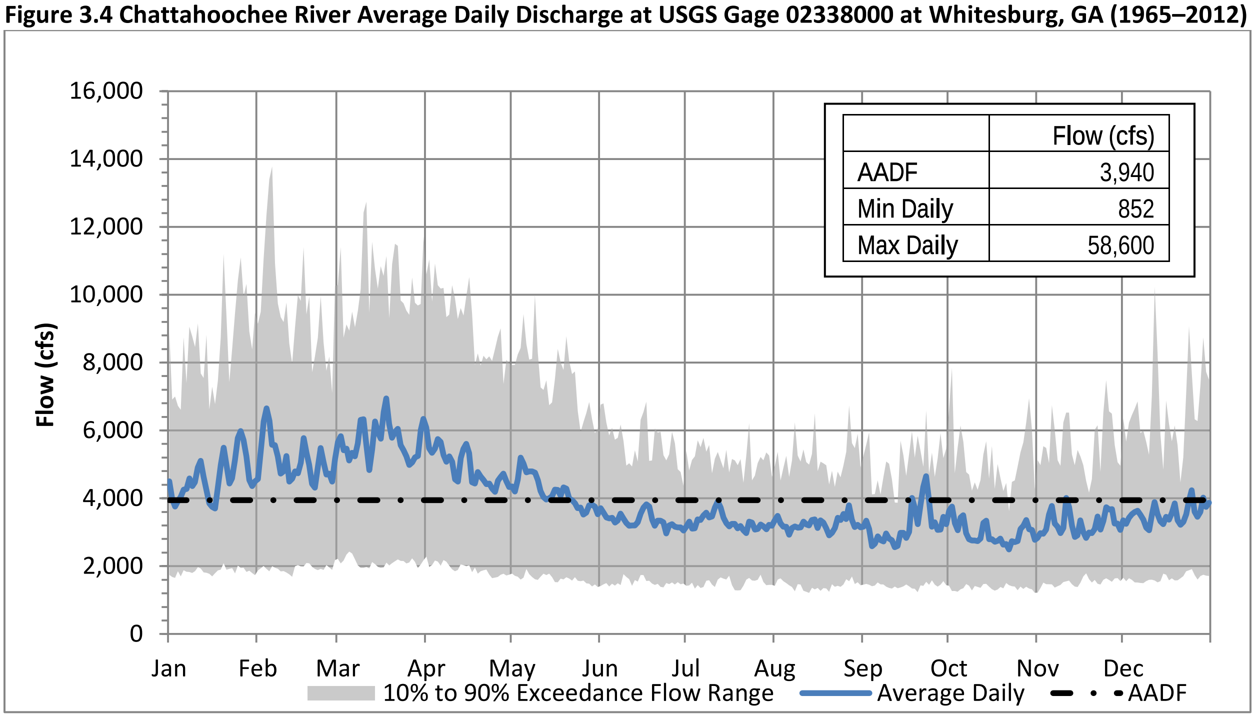
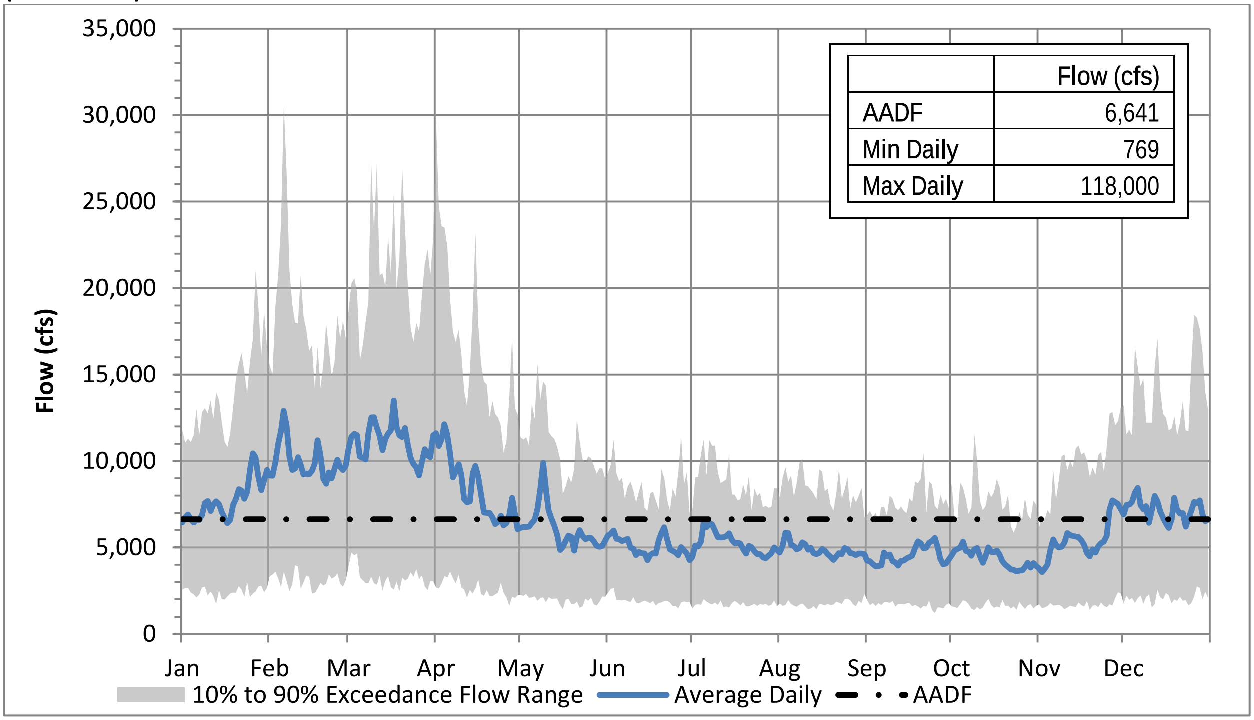


Figure 3.5 Chattahoochee River Average Daily Discharge at USGS Gage 02341505 at US 280 near Columbus, GA (1975–2011)[1]



[1] Record at USGS gage 02341505 starts on 8/23/1929. This figure shows flow at the gage after Buford and West Point Dams were built upstream.

Table 3.3 summarizes the daily streamflow values based on the associated frequency of the exceedance (expressed in % of time the value is exceeded).

Table 3.3 Chattahoochee River Daily Streamflow Values (cfs) based on Percent Exceedance at USGS Gages at Cornelia, Atlanta, Whitesburg, and Columbus, GA

% Exceedance	Cornelia[1] (1958–2011)	Atlanta[2] (1958–2011)	Whitesburg[3] (1965–2011)	Columbus[4] (1975–2011)
1	3,320	9,500	17,535	33,887
10	1,320	5,088	7,490	12,700
25	939	3,280	4,560	8,110
50	631	1,930	2,910	4,930
75	422	1,290	2,030	2,750
90	289	1,070	1,570	1,840
99	150	816	1,110	1,220

[1] USGS gage 02331600 at Cornelia, Georgia (1958–2012), drainage area = 315 sq mi.

[2] USGS gage 02336000 at Atlanta, Georgia (1958–2012), drainage area = 1,450 sq mi.

[3] USGS gage 02338000 at Whitesburg, Georgia (1965–2012), drainage area = 2,430 sq mi.

[4] USGS gage 02341505 at US 280, near Columbus, Georgia (1975–2011), drainage area = 4,670 sq mi.

Flint River

The Flint River originates just south of Atlanta and flows about 350 miles in a southerly direction to join the Chattahoochee River at Lake Seminole in southwest Georgia. It is entirely contained within the state of Georgia.

Stream flows on the Flint River exhibit a more natural pattern than those on the Chattahoochee River because of the lack of regulation. There are onlytwo dams: Lake Blackshear and Chehaw Dam (formerly known as Lake Worth) on the Flint. There also is a substantial groundwater-to-surface water transfer in the lower portions of the Flint River, which helps to sustain higher winter flows in the river.

Because the affected areas of the Proposed Project and the alternatives carried forward for further evaluation are in the Chattahoochee River Basin, any impacts that could be expected would occur only on the Chattahoochee River and downstream on the Apalachicola River. No further analysis was conducted for the Flint River for this EIS as no impacts to the Flint River are anticipated.

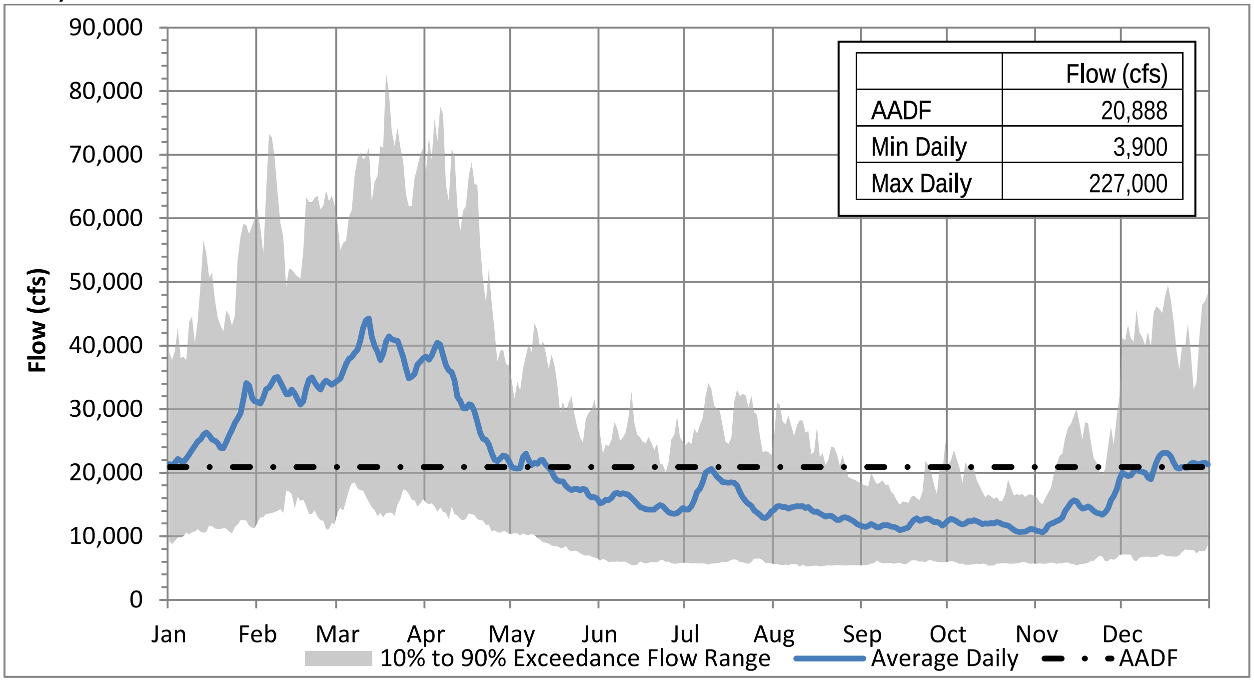
Apalachicola River

The Flint and Chattahoochee Rivers converge at Lake Seminole, which is formed by the Jim Woodruff Lock and Dam. The Apalachicola River flows unimpeded for approximately 107 miles from the dam near the Florida-Georgia state line to the Gulf of Mexico at Apalachicola Bay, a major fishery resource for oysters, shrimp, and finfish. The river drains about 2,440 sq mi, and its shallow estuary covers about 208 sq mi. Tides in the Gulf of Mexico influence the Apalachicola River approximately over its lower 25 miles. The tides have a mean range of 2 feet. The discharge of the Apalachicola River accounts for 35% of the freshwater flow on the western coast of Florida (Couch et al., 1996).

Historically, observed daily flows at the Chattahoochee gage averaged 20,888 cfs and ranged from a low of 3,900 cfs (during the 1986 to 1987 drought) to a peak of 291,000 cfs in 1929 before many of the upstream reservoirs were built (USGS, 2009b). The width of the river ranges from several hundred feet when confined to its banks to nearly 4.5 miles during flood flows. Current operations maintain a minimum discharge from Jim Woodruff of 5,000 cfs (4,500 cfs during drought operations).

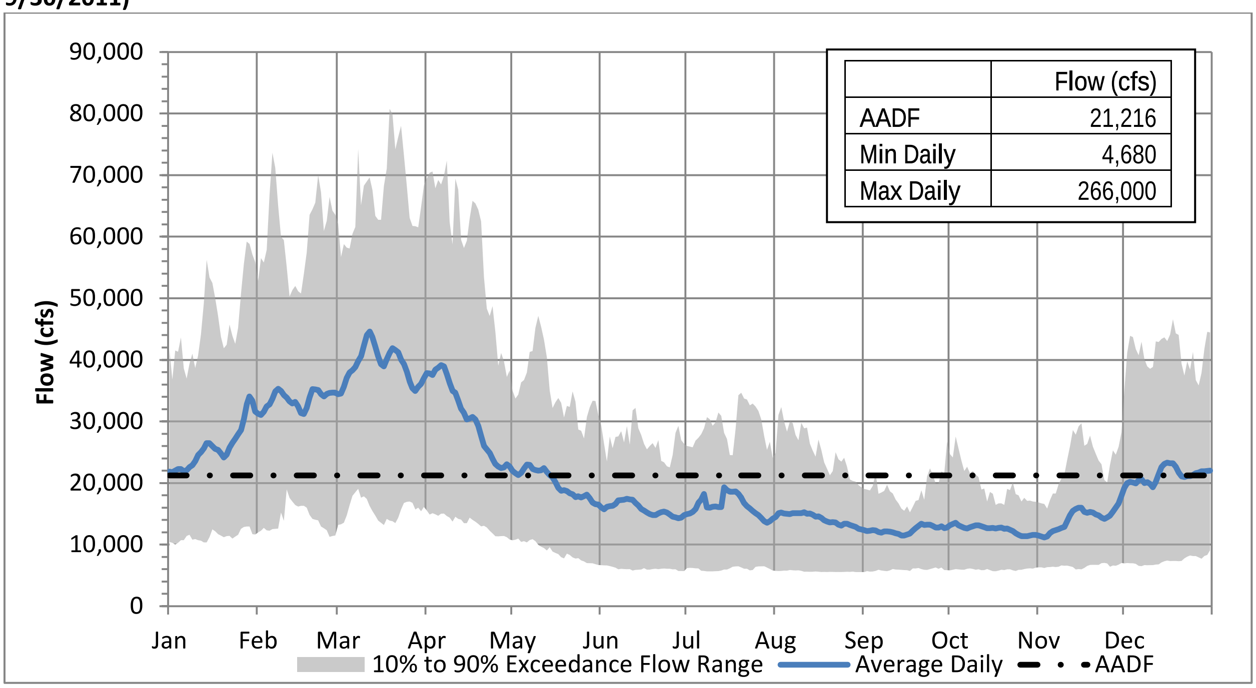
The observed daily discharges at the USGS gages near Chattahoochee and Blountstown, Florida, on the Apalachicola River are illustrated on **Figure 3.6** and **Figure 3.7**. Similar to the pattern exhibited by the Chattahoochee River, flows on the Apalachicola River are highest in spring and lowest in late summer. The annual duration streamflow values and the frequency of exceedance (expressed in percent) are summarized in **Table 3.4**.

Figure 3.6 Apalachicola River Average Daily Discharge at USGS Gage 02358000 at Chattahoochee, FL (1975–2011)[1]



[1] Record at USGS gage 02358000 starts on 10/1/1928. This figure shows flow at the gage after Buford and West Point Dams were built upstream.

Figure 3.7 Apalachicola River Average Daily Discharge at USGS Gage 02358700 at Blountstown, FL (1975–9/30/2011)[1]



[1] Record at USGS gage 02358700 starts on 10/1/1957. This figure shows flow at the gage after Buford and West Point Dams were built upstream.

Table 3.4 Apalachicola River Daily Streamflow Values (cfs) based on Percent Exceedance at USGS Gages at Chattahoochee and Blountstown, FL (1939–2011)

% Exceedance	Chattahoochee[1]	Blountstown[2]
1	87,800	84,055
10	43,300	43,000
25	25,200	26,400
50	14,900	15,400
75	9,850	10,400
90	6,520	6,890
99	5,031	5,460

[1] USGS gage 02358000 at Chattahoochee, FL (1975–2011), drainage area = 17,200 sq mi.

[2] USGS gage 02358700 Blountstown, FL (1975–9/30/2011), drainage area = 17,600 sq mi.

Reservoirs in the ACF River Basin

A total of 16 dams currently exist on the main stems of the three ACF rivers; 13 dams are on the Chattahoochee River, two are on the Flint River, and one is on the Apalachicola River. **Table 3.5** summarizes basic information on these dams and reservoirs, and **Figure 3.8** shows the locations of these dams. The Corps operates five of these dams in the ACF River Basin, located at the following Chattahoochee river miles (as measured from the confluence with the Flint River): Buford Dam (mile 348.3), West Point Dam (mile 201.4), Walter F. George Dam (mile 75.2), George W. Andrews Dam (mile 46.5), and Jim Woodruff Dam (mile 0).

Buford Dam, West Point Dam, and Walter F. George Lock and Dam impound reservoirs (Lake Lanier, West Point Lake, and Lake Eufaula, respectively) with a combined storage capacity of about 1.6 million acre-feet (ac-ft). George W. Andrews is a lock and dam without any appreciable water storage. Jim Woodruff Lock and Dam (Lake Seminole) is operated as a run-of-river project, and only very limited storage is available to support project purposes (Corps, Mobile District 1998a).

Table 3.5 Major Dams and Impoundments in the ACF River Basin

Project Name	Owner	Year Initially Completed	Drainage Area (sq mi)	Reservoir Size (ac)	Normal Pool Lake Elevation	River Mile
Buford Dam (Lake Lanier)	Corps	1957	1,040	38,542	1,071	348
Morgan Falls Dam (Bull Sluice Lake)	GPC	1903	1,340	580	866	313
West Point Dam (West Point Lake)	Corps	1975	3,440	29,900	635	201
Langdale Dam	GPC	1860	3,600	152	548	N/A
Riverview Dam	GPC	1902	3,600	75	531	N/A
Bartletts Ferry Dam (Lake Harding)	GPC	1926	4,260	5,850	521	178
Goat Rock Dam (Goat Rock Lake)	GPC	1912	4,500	1,050	404	172
Oliver Dam (Oliver Lake)	GPC	1959	4,630	2,150	337	164
North Highlands Dam	GPC	1900	4,630	131	269	163
City Mills (Inoperative)	City Mills	1963	4,630	110	226	161
Walter F. George Lock and Dam (Lake Eufaula)	Corps	1963	7,460	45,180	190	75
George W. Andrews Lock and Dam (George W. Andrews Lake)	Corps	1963	8,210	1,540	102	47
Jim Woodruff Lock and Dam (Lake Seminole)	Corps	1954	17,230	37,500	77	108
Warwick Dam (Lake Blackshear)	Crisp County Power Commission	1930	3,764	8,700	237	135
Chehaw Dam (formerly Lake Worth)	GPC	1908	N/A	1,400	182	N/A

Notes:

GPC = Georgia Power Company

N/A = Not Applicable

All but the following dams are on the Chattahoochee River: Warwick Dam and Chehaw Dam are on the Flint River, and Jim Woodruff Dam is on the Apalachicola River.

Figure 3.8 Location Map of the Existing Reservoirs in the ACF River Basin

The remainder of this subsection provides an overview of the major federal reservoir projects on the Chattahoochee River that are operated by the Corps; additional background information about other dams in the ACF River Basin can be found in the draft Master Water Control Plan for the ACF River Basin (Corps, Mobile District 1989a).

Lake Lanier

Lake Lanier is formed by Buford Dam, which is about 40 miles northeast of Atlanta on the Chattahoochee River. The Chestatee and Chattahoochee Rivers combine in the upper reservoir pool and comprise about 84% of the 1,040 sq mi of drainage area into the pool. The Buford Dam drainage area lies on the southern slope of the Blue Ridge Mountains and is characterized by the steep slopes of mountain streams. The dam is at mile 348.3 on the Chattahoochee River.

Lake Lanier provides the major stream regulation in the ACF River Basin. This federal reservoir provides 65% of the total conservation storage capacity available in the basin for flow regulation. However, it only controls runoff from 5.3% of the basin's total drainage area. Authorized purposes consist of water supply, hydropower, flood control, and navigation.

West Point

West Point Lake is formed by West Point Dam, a Corps' reservoir on the Alabama-Georgia state line near West Point, Georgia at Chattahoochee River mile 201.4. The upstream end of West Point Lake is about 120 miles downstream from Morgan Falls Dam, and the Chattahoochee River is free-flowing over that distance.

The drainage area above West Point Dam, 3440 sq mi, represents about 40% of the Chattahoochee River basin. The drainage area between Buford Dam and West Point Dam is 2,400 sq mi. It is a multi-purpose project with major project purposes, including flood control, hydroelectric power, recreation, fish and wildlife development, and streamflow regulation for downstream navigation.

Walter F. George

Walter F. George Lake, also known as Lake Eufaula, is created by the Walter F. George Lock and Dam on the Chattahoochee River at river mile 75.2. The Walter F. George Lock and Dam is located on the Chattahoochee River approximately one mile north of Fort Gaines, Georgia, and approximately 1.6 miles upstream from the Georgia State Highway 37 bridge. The drainage area above Walter F. George Lock and Dam is 7,460 sq mi. The authorized purposes for the Walter F. George Dam and Reservoir include fish and wildlife enhancement, hydroelectric power generation, flood control, navigation, recreation, and water quality.

George W. Andrews

The George W. Andrews Lock and Dam are at Chattahoochee River mile 46.5, about 154 miles upstream of Apalachicola Bay and about 28.3 miles below Walter F. George Dam. The lock and dam is about 2 miles south of Columbia, Alabama, and about 17 miles east of Dothan, Alabama. The drainage area above the lock and dam is 8,210 sq mi. George W. Andrews Lock and Dam is a single purpose project designed to aid navigation by providing a 9-foot navigation channel upstream to Walter F. George Lake and by maintaining a more uniform downstream flow.

Jim Woodruff

Jim Woodruff Lock and Dam are on the Apalachicola River, 107.6 miles above its mouth, about 1,000 feet below the confluence of the Chattahoochee and Flint Rivers, and 1.5 miles northwest of Chattahoochee, Florida. It is the farthest downstream reservoir in the ACF River Basin. The reservoir, Lake Seminole, extends about 46.5 miles upstream along the Chattahoochee River to the vicinity of Columbia, Alabama, and about 47 miles upstream along the Flint River, or 17 miles above Bainbridge, Georgia. The project was completed in 1957. The drainage area above Jim Woodruff Dam, 17,230 sq mi, is about equally divided between the Chattahoochee and Flint Rivers. Jim Woodruff is a multi-purpose project created primarily to aid navigation in the Apalachicola River below the dam and in the Chattahoochee and Flint Rivers above the dam to generate electric power.

3.3.1.2 Chattahoochee River Upstream of Lake Lanier

Both the Applicant's Proposed Project (Glades Reservoir) and the alternative White Creek Reservoir site are located in the Upper Chattahoochee River Basin, the most upstream segment in the ACF watershed. The upper reaches of the basin streams are characterized by the steep slopes of mountain streams. These streams typically have higher sustained flows during winter months and respond quickly to storm events throughout the year (Couch et al., 1996). This is also illustrated by the wide range of daily flows observed at the USGS gage at Cornelia, Georgia (**Figure 3.2** in the previous subsection).

Figure 3.9 shows the river segments of the Chattahoochee River that would be impacted by the proposed pumped-storage operation. This figure shows the locations of the proposed raw water intakes at the Glades and White Creek Reservoirs and the Corps' property boundary for Lake Lanier. The river segments include the Upper Chattahoochee River from the proposed intake locations to Lake Lanier's northern boundary (the Corps' property boundary for Lake Lanier). This is approximately a 1-mile segment for the proposed intake location for the Glades Reservoir site and a 7-mile segment for the White Creek Reservoir intake location.

The flows in the Chattahoochee River at the proposed intake locations were calculated using a drainage area ratio conversion using the daily streamflow records from the USGS gage on the Chattahoochee River at Cornelia (gage 02331600). The gage has a drainage area of 315 sq mi,[2] and a 55-year period of record (1/1/1958 through 12/31/2012) was used to estimate the daily flow available at the proposed intake sites. The AADF was estimated to be 922 cfs at the proposed Glades Reservoir intake and 784 cfs at the proposed White Creek Reservoir intake. **Table 3.6** summarizes the flow statistics at the proposed intake locations. The range of daily flows vary widely at the proposed intake and pump station locations, from less than 100 cfs during extreme low flow periods to over 15,000 cfs during high flow periods in winter.

[2] Data from USGS gage 02331600 Chattahoochee River near Cornelia, Georgia, were downloaded from USGS Streamstats. Data from 8/21/1957 through 12/31/2012 have been approved for publication.

Table 3.6 Summary of Daily Streamflow at the Proposed River Intake Locations

Proposed Intake on the Chattahoochee River	Glades (Flat Creek)	White Creek
Drainage area (sq mi)	374	318
Annual Average Daily Flow (cfs)	922	784
Minimum Daily Flow (cfs)	78	67
Maximum Daily Flow (cfs)	18,759	15,950

Notes:
1. Period of record analyzed: 1/1/1958 through 12/31/2012
2. The flows in the Chattahoochee River at the proposed intake locations were calculated using a drainage area ratio conversion based on daily streamflow records from the USGS gage on the Chattahoochee River at Cornelia, Georgia (gage 02331600).

Figure 3.9 also shows how Lake Lanier's water level and operation may affect this stretch of the Chattahoochee River. The figure shows how far north the normal pool (full summer pool at 1071 feet mean sea level [MSL]) and flood pool (1085 ft MSL) water surface levels can reach and whether the proposed intake locations may be under the influence of the lake operation. The confluence of Flat Creek is below the summer full pool level of 1071 ft MSL and winter full pool of 1070 ft MSL. The water levels at Lake Lanier fluctuate between a low lake level of 1060 ft MSL and the summer full pool level of 1071 ft MSL and Flat Creek would be constantly under the influence of Lake Lanier operation. The proposed intake for the White Creek Reservoir site is upstream of the flood pool water surface level of 1085 ft MSL, while the proposed intake location for the Glades Reservoir is just upstream of the summer normal pool at 1071 ft MSL but can occasionally be affected during the time the lake is operated for flood risk management.

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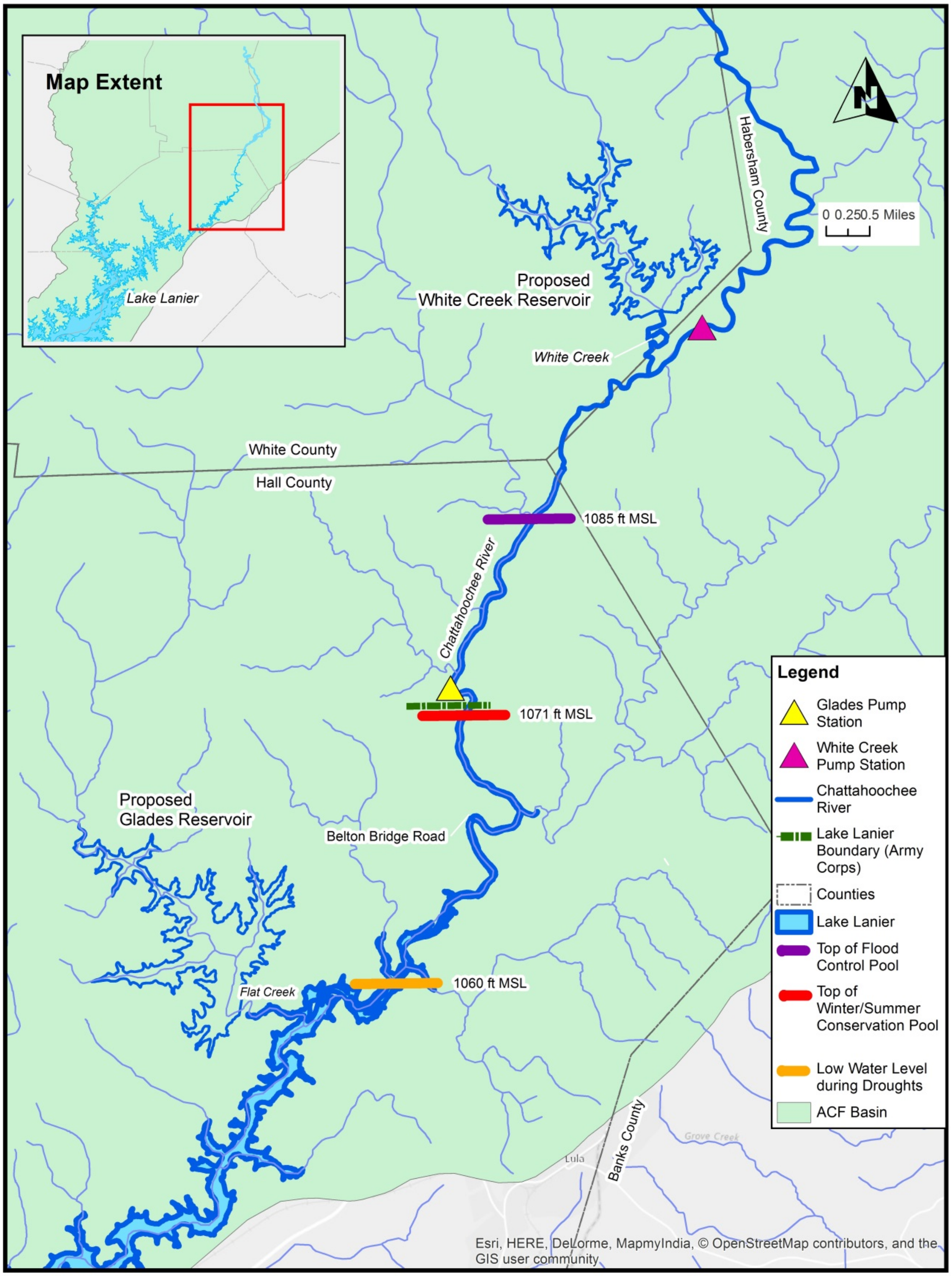
Figure 3.9 Chattahoochee River Upstream of Lake Lanier



Glades Reservoir River Intake

The Applicant's proposed intake site is located on the Chattahoochee River less than 0.4 mile upstream from the upper limit of the Corps' fee simple ownership boundary for Lake Lanier (drainage area = 374 sq mi). The latitude and longitude of the intake was expressed as 34°28'15", 83°41'16" in the withdrawal application submitted by Hall County to the Georgia Department of Natural Resources, Environmental Protection Division (Georgia EPD). This location is approximately 2.5 miles upstream of the Belton Bridge, or approximately 5.9 miles upstream of Lula Bridge on State Route 52 (SR 52) as stated by the Applicant. The site is situated on the west bank of the river, near the center of a slight sweeping bend, which results in deeper water on the western side of the river. The river bottom and riverbank composition is predominantly sand and gravel. The riverbank area consists of an elevated floodplain with second growth bottomland hardwood trees.

The Applicant's proposed intake site is a reasonable choice for the following reasons:

- The Applicant's proposed raw water intake site is north of the jurisdictional boundary, south of extensive shoals and shallow water, and located on an outside bend of the river providing maximum water depth for the reach of the river.
- The topography lends itself to construction of an intake and pumping station pending confirmation of site availability, easement acquisition, and geotechnical investigation.

The estimated mean daily discharges, calculated based on the 55-year observed stream flow record from the USGS gage at Cornelia at the proposed intake location is illustrated in **Figure 3.10**. AADF at the proposed intake location is approximately 922 cfs and the estimated daily flow range from 78 to 18,759 cfs.

White Creek Reservoir River Intake

The proposed intake site for White Creek Reservoir is located in White County on the Chattahoochee River approximately 6.2 miles upstream from the upper limit of the Corps fee simple ownership boundary for Lake Lanier. This location is approximately 2.6 miles north of the Hall-White county line. The site is situated on the west bank of the river, south of a sweeping bend. **Figure 3.11** shows the estimated mean daily discharges at the proposed intake location for White Creek Reservoir**.** AADF at the proposed intake location is approximately 784 cfs and the estimated daily flow range from 67 to 15,950 cfs.

Figure 3.10 Chattahoochee River Average Daily Discharge at Glades Reservoir Pump Station (1958–2011)

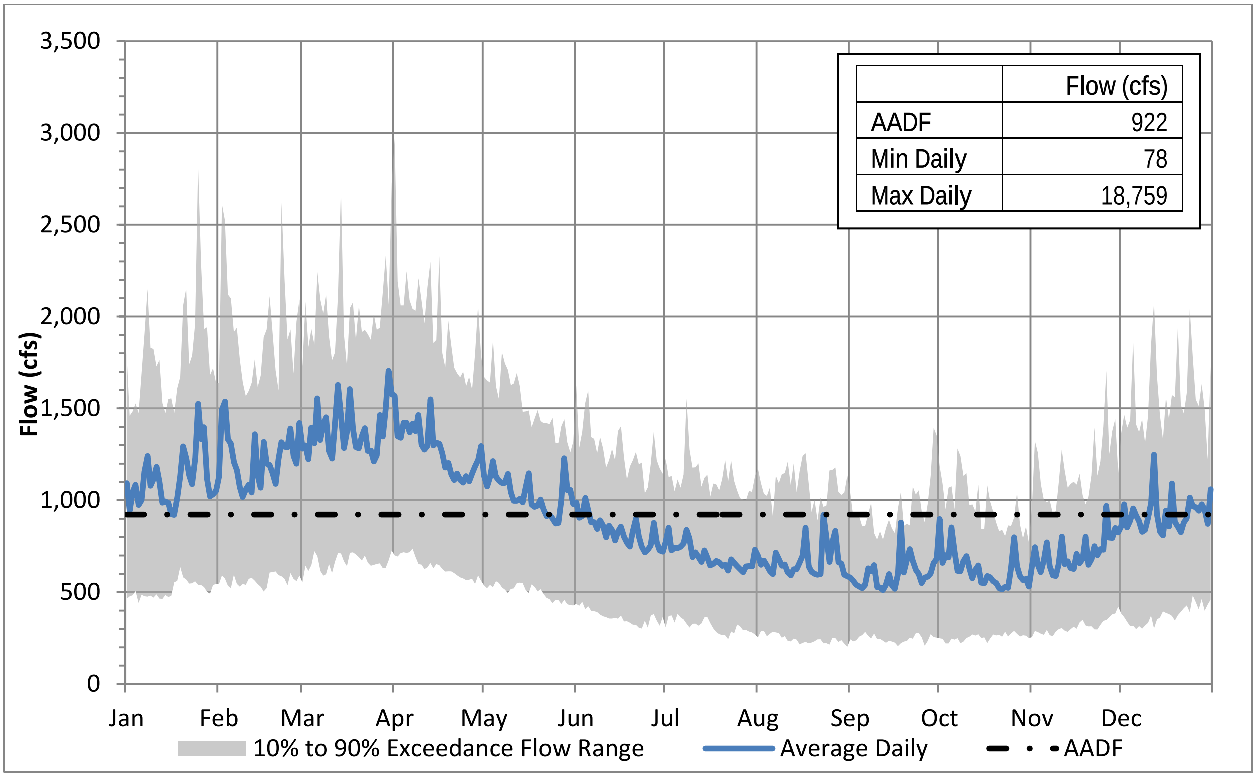
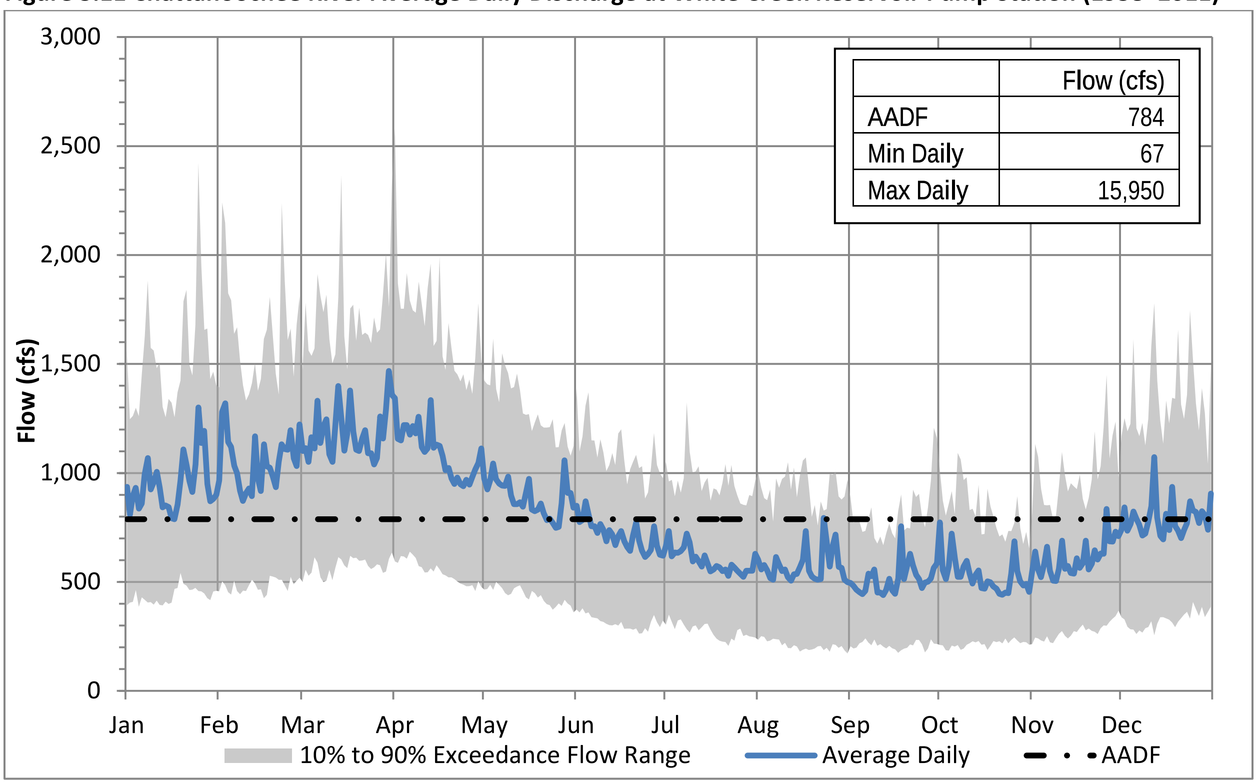


Figure 3.11 Chattahoochee River Average Daily Discharge at White Creek Reservoir Pump Station (1958–2011)



3.3.1.3 Tributaries Upstream of Buford Dam

This section presents an evaluation of the existing (baseline) conditions of the tributaries of the Chattahoochee River where alternative dam sites would be located, including Flat Creek (located in Hall County) and White Creek (located in White County).

Because no river gages exist on either Flat Creek or White Creek, flows have been estimated using the best available, most suitable nearby stream gages. Many factors were considered when selecting the applicable stream gage to simulate the flows at the potential dam sites including the size of drainage area, runoff ratio (flow divided by drainage area), general topography and watershed development conditions, and availability of long-term streamflow records. Flows on Flat Creek and White Creek were calculated using a drainage area ratio conversion that suitably estimates the streamflow at the proposed dam sites from the USGS Suwanee gage (gage 02334885) (drainage area = 47 sq mi)[3]. This gage has a 29-year period of record available (10/1/1984 through 12/31/2012) for analysis.

At the proposed Glades Dam site on Flat Creek, the estimated daily flows range from 0.4 cfs to 1,236 cfs with an average of 26 cfs. At the White Creek Dam site, the estimated flows range from 0.2 cfs to 716 cfs with an average of 15.1 cfs. **Table 3.7** summarizes the drainage area and estimated flow ranges at the two dam sites under consideration.

Table 3.7 Summary of Daily Streamflow Flow at Alternative Dam Sites (1985–2012) (cfs)

Description	Glades Reservoir	White Creek Reservoir
Drainage Area (sq mi)	17.6	10.2
AADF (cfs)	26.0	15.0
Minimum Daily Flow (cfs)	0.4	0.2
Maximum Daily Flow (cfs)	1,236.0	716.0

Notes:

1. Period of record analyzed: 1/1/1984 through 12/31/2012.
2. The flows in Flat and White Creek at the proposed dam sites were calculated using a drainage area ratio conversion based on daily streamflow records from the USGS gage on Suwannee Creek at Suwanee, GA (gage 02334885).

Flat Creek

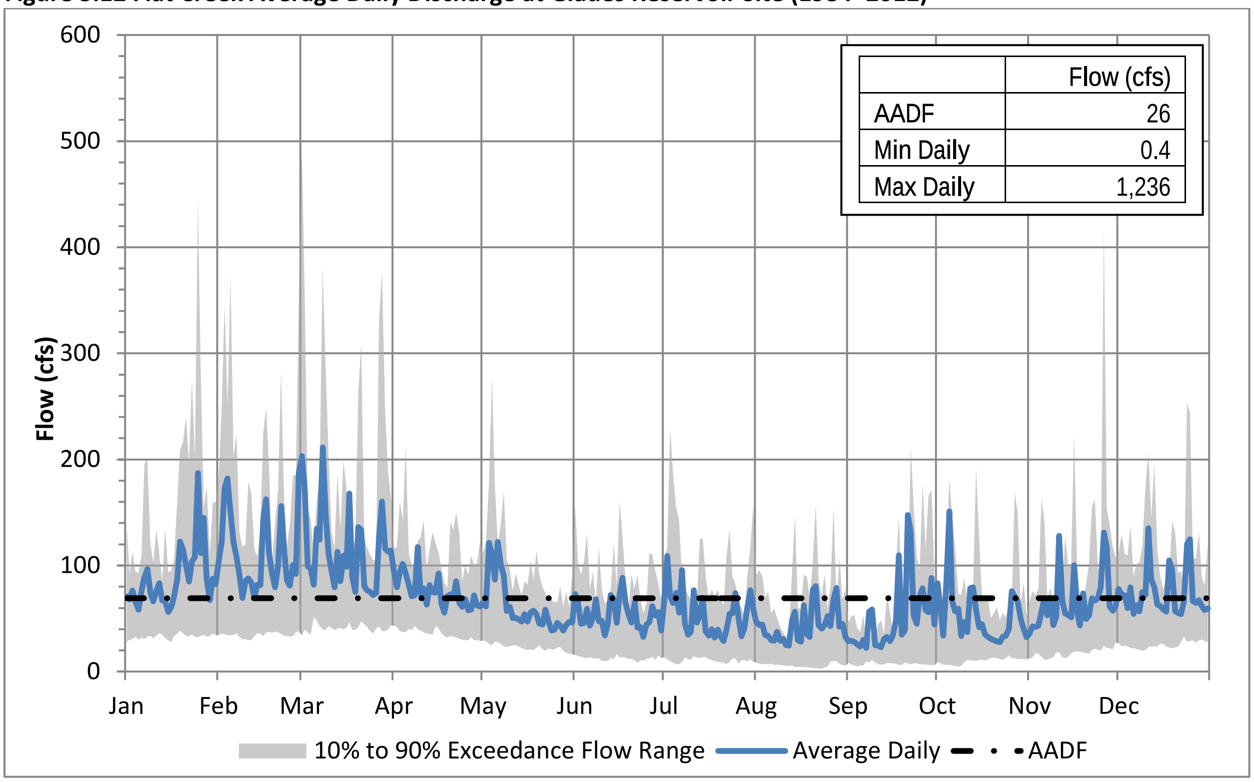
Glades Reservoir would be a pumped-storage reservoir located on Flat Creek, a tributary to the Chattahoochee River upstream of Lake Lanier. The Flat Creek Watershed consists of predominately forested, moderate to severe slopes with numerous drainages that flow generally northward towards Flat Creek and then to the Chattahoochee River and Lake Lanier. Flat Creek has a total drainage area of 18.1 sq mi, and the Chattahoochee River has a drainage area of 432 sq mi just above the confluence with Flat Creek.

[3] Data from USGS gage 02334885 Suwanee Creek at Suwanee, GA (drainage area = 47 mi^2) were downloaded from USGS Streamstats. Data from 10/1/1984- 12/31/2012 have been approved for publication.

Glades Reservoir would be located approximately 12 miles northeast of Gainesville, Georgia, northeast of US 23/365, near the US 23/365 SR 52 intersection. The dam for Glades Reservoir is located approximately 1,000 feet from Flat Creek's confluence with the Chattahoochee River located generally where Glade Farm Road crosses Flat Creek. **Figure 3.12** shows that Flat Creek is below Lake Lanier's property boundary and is downstream of the northern most point of Lanier's normal pool operation. The summer normal pool water surface elevation is 1071 ft MSL. The drainage area for Glades Reservoir is estimated to be 17.6 sq mi. The dam would impound an approximately 850-acre reservoir at a normal pool elevation of 1180 ft MSL and provide 11.7 billion gallons (BG) of water storage capacity.

The highest flows in Flat Creek typically occur in late winter/early spring months with the lowest flows occurring at the end of the summer in September. The flows in Flat Creek are flashier (responds quickly to storm events) and have more extreme variations from day to day compared to the flows in the Chattahoochee River. The simulated daily discharge at the dam site on Flat Creek is illustrated in **Figure 3.12**.

Figure 3.12 Flat Creek Average Daily Discharge at Glades Reservoir Site (1984–2012)



	Flow (cfs)
AADF	26
Min Daily	0.4
Max Daily	1,236

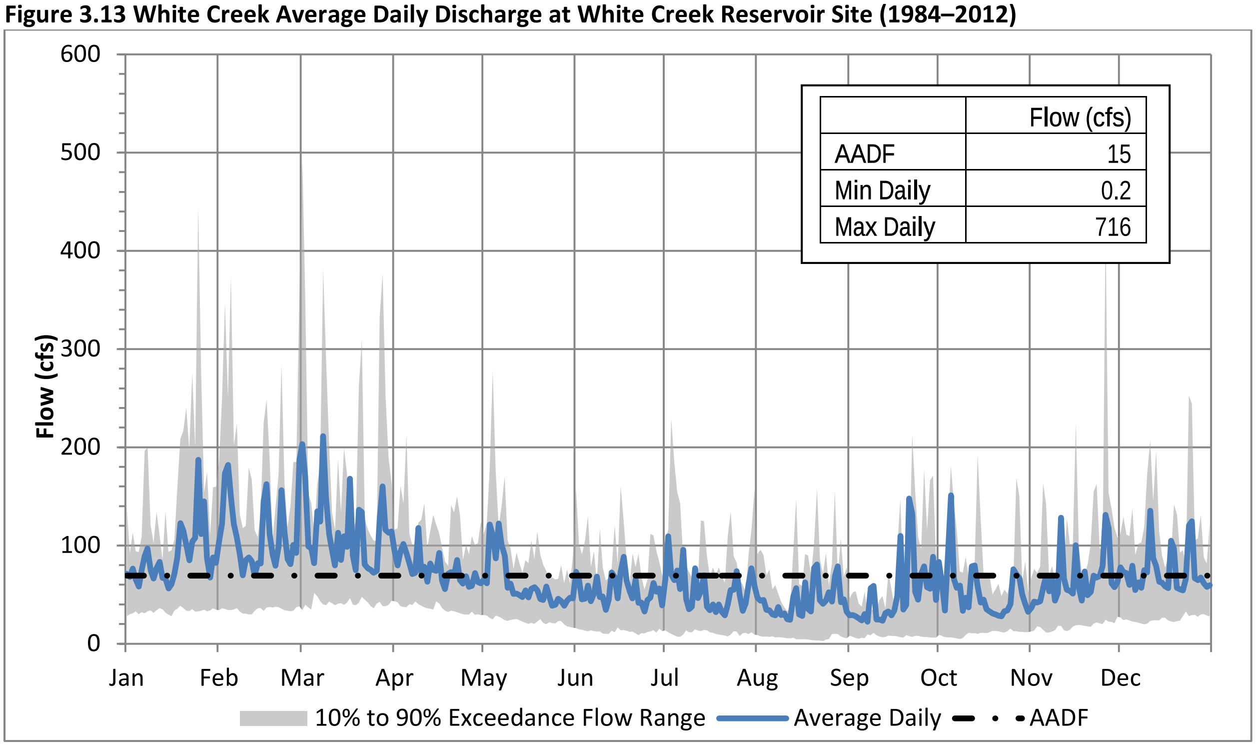
White Creek

This pumped-storage reservoir would be located on White Creek, a tributary to the Chattahoochee River upstream of Lake Lanier (and upstream of Flat Creek). The White Creek Watershed consists of predominately forested, moderate to severe slopes with numerous drainages that flow generally northward towards White Creek and eventually to the Chattahoochee River. A small lake, Webster Lake, is located within the sub-basin. White Creek has a total drainage area of 10.4 sq mi, and the Chattahoochee River has a drainage area of 320 sq mi just above the confluence with White Creek.

White Creek Reservoir would be located approximately 6 miles southwest of Demorest and 8 miles southeast of Cleveland, south of US 384 and the intersection with New Bridge Road. The dam for White Creek Reservoir is located approximately 4,500 feet from White Creek's confluence with the Chattahoochee River. **Figure 3.13** shows that White Creek is above Lake Lanier's property boundary and is upstream of Lake Lanier's flood pool operation (1085 ft MSL). The drainage area for White Creek Reservoir is estimated to be 10.2 sq mi. The dam would impound an approximately 470-acre reservoir at a normal pool elevation of 1305 ft MSL and provide 4.2 BG of useable water storage volume.

Similar to Flat Creek, the high flows are anticipated in the late winter/early spring months and the lowest flows at the end of the summer in September. The small watershed and its terrain also means the flows in White Creek can increase quickly during a storm event and results in more extreme variations in flows from day to day, compared to the flows on the Chattahoochee River. The simulated daily discharge at the White Creek dam site is illustrated in **Figure 3.13**.

Figure 3.13 White Creek Average Daily Discharge at White Creek Reservoir Site (1984–2012)



	Flow (cfs)
AADF	15
Min Daily	0.2
Max Daily	716

3.3.2 ACF Water Management

ACF water management is a complex process that requires consideration of many competing demands for water in the basin, consideration of past and anticipated future hydrologic conditions, collaboration with agencies and stakeholders, and determination of the most appropriate operating conditions for all the reservoirs in the basin to meet both the human and natural system needs.

This section discusses the five federal reservoirs in the ACF River Basin operated by the Corps Mobile District.

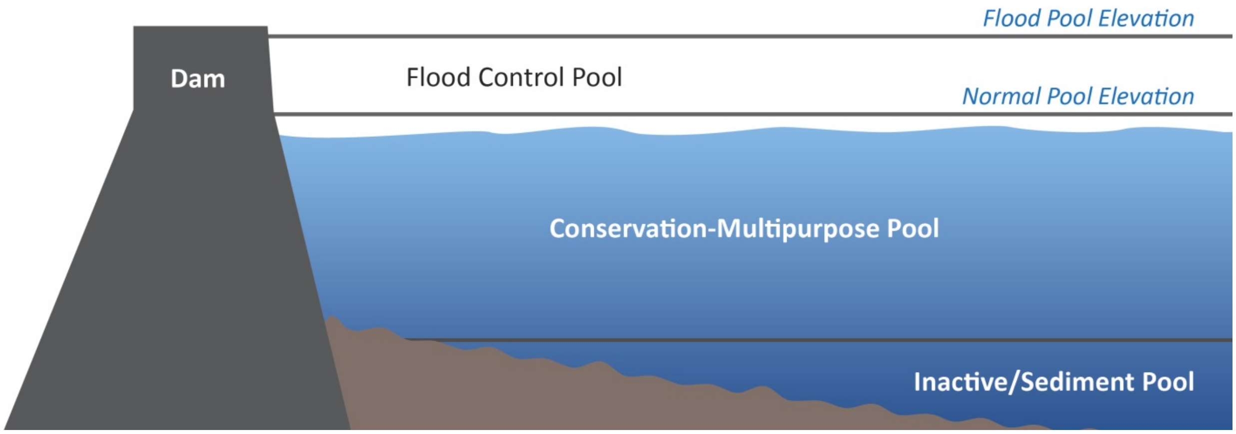
3.3.2.1 Operation of Federal Reservoirs

The federal reservoirs in the ACF River Basin are operated for various purposes, including flood damage reduction (formerly referred to as flood control), hydroelectric power generation, navigation, fish and wildlife conservation, recreation, water supply, and water quality. Fish and wildlife conservation, recreation, water quality, and water supply are considered purposes under general legislation, including the Water Protection Recreation Act, Water Pollution Act of 1972 as amended, Water Supply Act of 1958, Fish and Wildlife Coordination Act, and Endangered Species Act (ESA). West Point Lake is the exception where fish and wildlife conservation and recreation are specifically cited purposes. The Corps policy states that legally authorized purposes recognized after project construction receive appropriate consideration when making water control decisions, just as those purposes for which costs have been allocated.

The multi-purpose Corps projects are operated in a balanced manner within the ACF system to support all authorized project purposes to the extent practicable, while continuously monitoring the total system water availability to ensure that project purposes can at least be minimally satisfied during critical drought periods. To accomplish this, the Corps uses two strategies – a balanced water management strategy across all federal reservoirs and defined action zones at each reservoir.

The balanced water management strategy takes in account the amount of available water storage in the four principal Corps reservoirs (Buford, West Point, Walter F. George, and Jim Woodruff) to provide system-wide balance in using conservation storage (**Figure 3.14**). This strategy maintains a balanced use of conservation storage among all reservoirs in the system, which requires fluctuations in pool elevations at the storage reservoirs. At the same time, action zones have been defined for each of the major storage reservoirs in the ACF system—Lake Lanier, West Point Lake, and Walter F. George Lake. These action zones, which are discussed below for each reservoir, are used to determine minimum discharge releases from the reservoirs for fish and wildlife conservation and hydropower generation, and maximum navigation releases from conservation storage in the lakes, while balancing the lake levels in a system-wide approach. The zones are used to manage the lakes at the highest level possible, while balancing the needs of all the authorized purposes. Zone 1, the highest in each lake, defines a reservoir condition where all authorized project purposes can be achieved. As lake levels decline, Zones 2 through 4 define increasingly critical system water shortages and guide the Corps in reducing flow releases as it becomes increasingly difficult to operate the system for all approved purposes.

Figure 3.14 Reservoir Storage Pools



To meet these competing needs in the system, the strategy of operating the federal reservoirs calls for water to be released first from storage in the lower lakes on the system and gradually pulling water from the upper lakes over time. Thus, Walter F. George Lake, which contains most of the storage on the lower system, because Lake Seminole does not have much storage, is the first lake to be affected by operations on the system during periods of low water supply. If conditions remain dry, water will also be released from storage in West Point Lake and eventually from Lake Lanier. This is all done in accordance with the action zones and guidelines in the existing WCM, which attempts to equitably balance the lakes in the system. Varying hydrologic conditions throughout the ACF River Basin may result in the lakes temporarily getting out of balance; but, eventually, they will be brought back into balance according to the WCM.

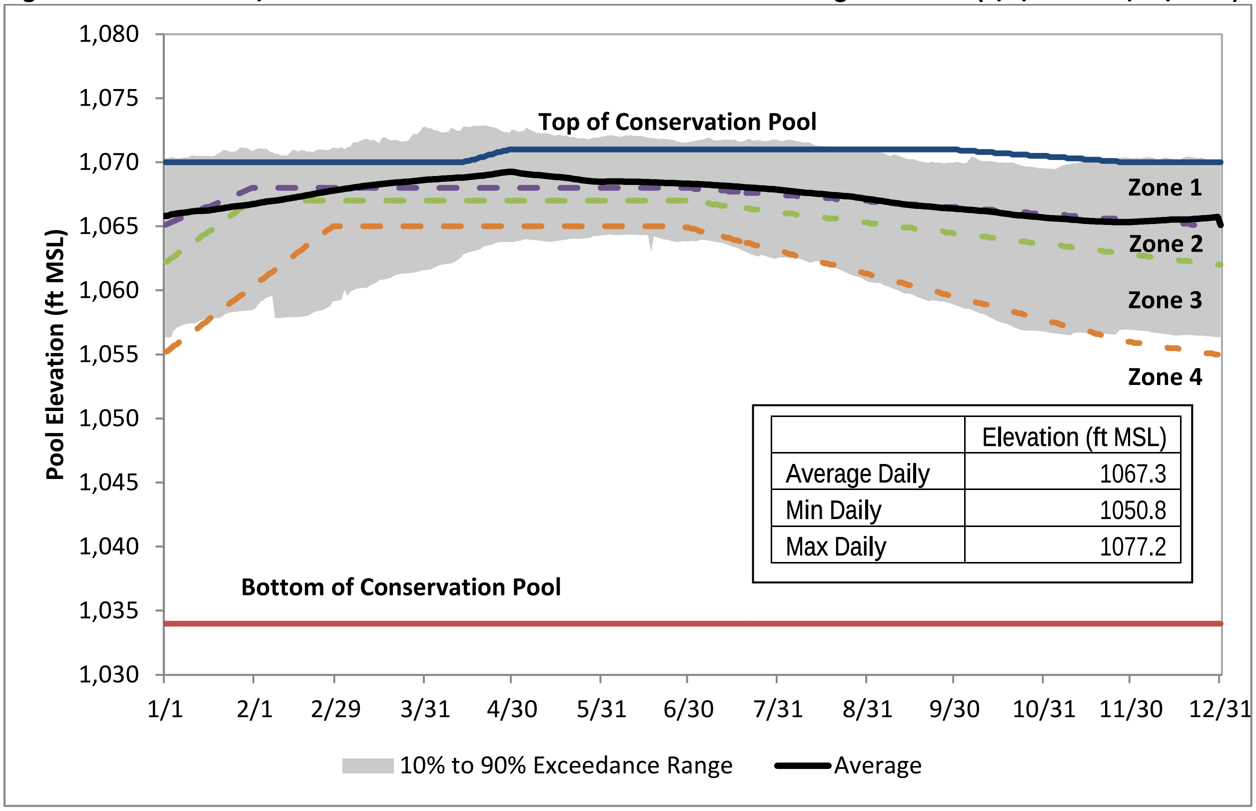
ACF River Basin water control operations consider all project functions and account for the full range of hydrologic conditions from flood to drought. Because actions taken at the upstream portion of the basin affect conditions downstream, the federal projects in the ACF River Basin are operated as a system rather than as a series of individual, independent projects. The balancing of water control operations to meet each of these purposes varies between the individual projects and time of year. Operation of the projects is usually performed in a manner which represents a consideration of these oftentimes competing purposes and, whenever possible, reservoir operations are managed to accommodate these purposes in a complementary fashion. Water control objectives and operational guidelines for federal reservoirs in the ACF River Basin are recorded in WCMs.

Buford Dam and Lake Lanier

Lake Lanier is the largest water supply source in the Atlanta metropolitan area. In 2011, the cities of Cumming, Buford, and Gainesville, and Forsyth and Gwinnett counties withdrew more than 115 mgd (annual average) from Lake Lanier (**Appendix P**, State of Georgia's Water Supply Request, January 11, 2013). Water systems that rely on water supply releases from Lake Lanier to the Chattahoochee River include Cobb, DeKalb, and Fulton counties and the City of Atlanta, with an estimated 2011 withdrawal of 245.7 mgd (annual average).

The Lake Lanier guide curve (**Figure 3.15**) establishes the top of conservation pool at elevation 1071 ft MSL during the late spring and summer months (May through September) and 1070 ft MSL during the remainder of the year. The observed record high elevation for the lake under flood conditions was elevation 1077.2 ft MSL (April 1964) and the lowest observed level was 1050.8 ft MSL (December 2007) under extreme drought conditions. Under drier conditions, when basin inflows are reduced, project operations are adjusted to conserve storage in Lake Lanier while continuing to meet project purposes. The average daily elevation is shown against the Lake Lanier action zones in **Figure 3.15**.

Figure 3.15 Lake Lanier/Buford Dam Water Control Action Zones and Average Elevation (2/8/1956–12/31/2012)

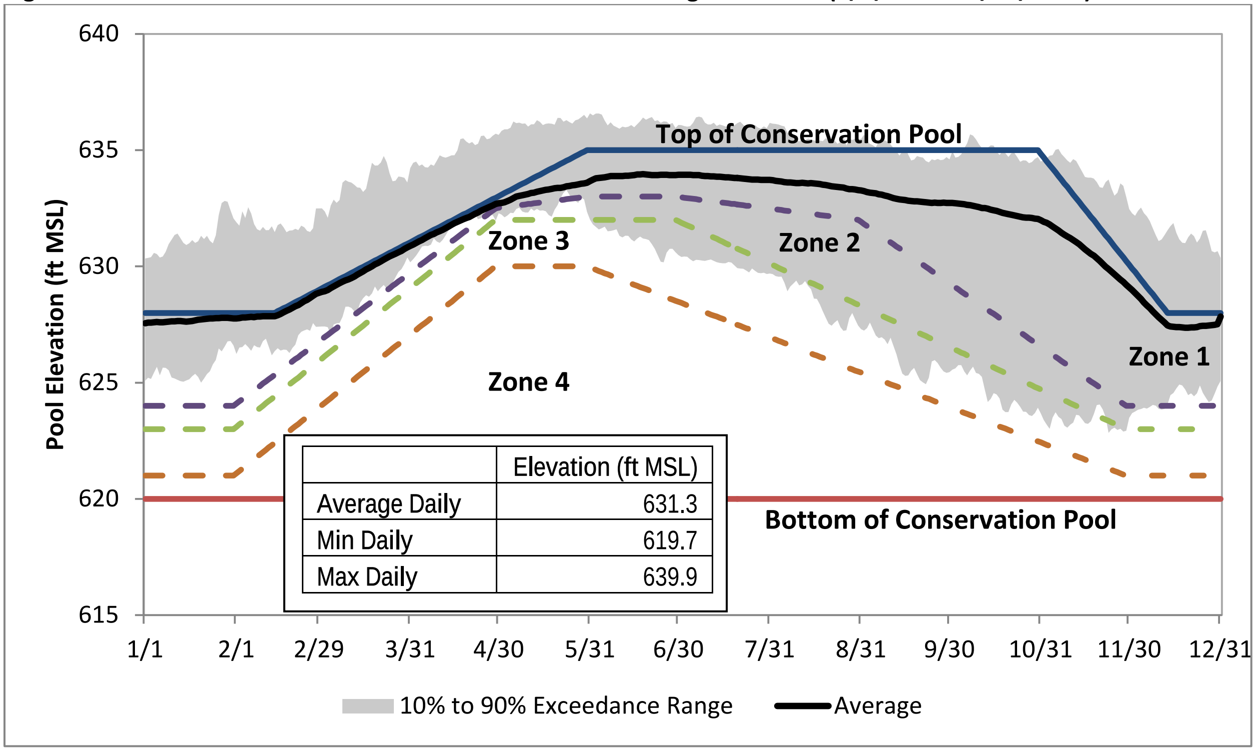


	Elevation (ft MSL)
Average Daily	1067.3
Min Daily	1050.8
Max Daily	1077.2

West Point Dam and Reservoir

The West Point Dam and Lake is a multi-purpose project with primary purposes including flood damage reduction, hydroelectric power, recreation, fish and wildlife development, and stream flow regulation for downstream navigation. The West Point Lake guide curve (**Figure 3.16**) establishes the top of conservation pool at elevation 635 ft MSL from June through October, transitioning to elevation 628 ft MSL from December through mid-February. The observed record high elevation for the lake under flood conditions was elevation 639.9 ft MSL (May 2003), and the lowest level was 619.7 ft MSL (November 1985). Under drier conditions when basin inflows are reduced, project operations are adjusted to conserve storage in West Point Lake while continuing to meet project purposes. Flood flows captured in the reservoir are generally released slowly over the subsequent weeks, unless additional flood flows are expected. Power releases during the low-flow season augment flows at the Georgia Power Company projects along the Chattahoochee River and also provide water for municipal and industrial needs in the vicinity of Columbus, Georgia, and to support navigation on the Apalachicola River below Jim Woodruff Lock and Dam.

Figure 3.16 West Point Water Control Action Zones and Average Elevation (5/9/1975–12/31/2012)

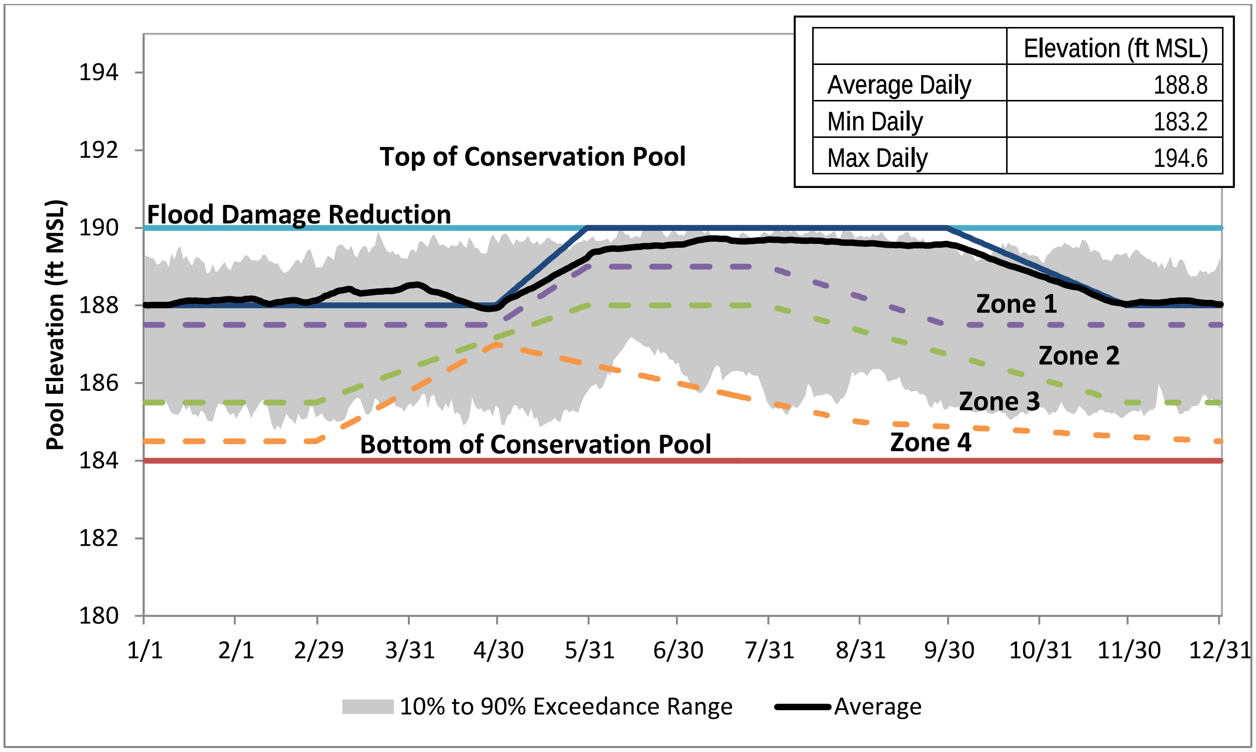


Walter F. George Dam and Reservoir

The authorized purposes for the Walter F. George Dam and Reservoir include fish and wildlife enhancement, hydroelectric power generation, navigation, recreation, and water quality. The reservoir provides a 9-foot depth in the navigation channel that extends upstream to Columbus, Georgia. The existing projects (Walter F. George, George W. Andrews, and Jim Woodruff) authorize a 9-foot waterway from Apalachicola, Florida to Columbus, Georgia, on the Chattahoochee River, and to Bainbridge, Georgia, on the Flint River. The project also provides flood damage reduction benefits during peak flow periods.

The Walter F. George Lake guide curve (**Figure 3.17**) establishes the top of conservation pool at elevation 190 ft MSL from June through September, transitioning to elevation 188 ft MSL from December through April. The observed record high elevation for the lake under flood conditions was elevation 194.7 ft MSL (March 1990), and the lowest level was 183.2 ft MSL (April 1965). Under drier conditions, when basin inflows are reduced, project operations are adjusted to conserve storage in Walter F. George Lake while continuing to meet project purposes.

Figure 3.17 Walter F. George Water Control Action Zones and Average Elevation (3/13/1963–12/31/2012)



George W. Andrews Dam and Reservoir

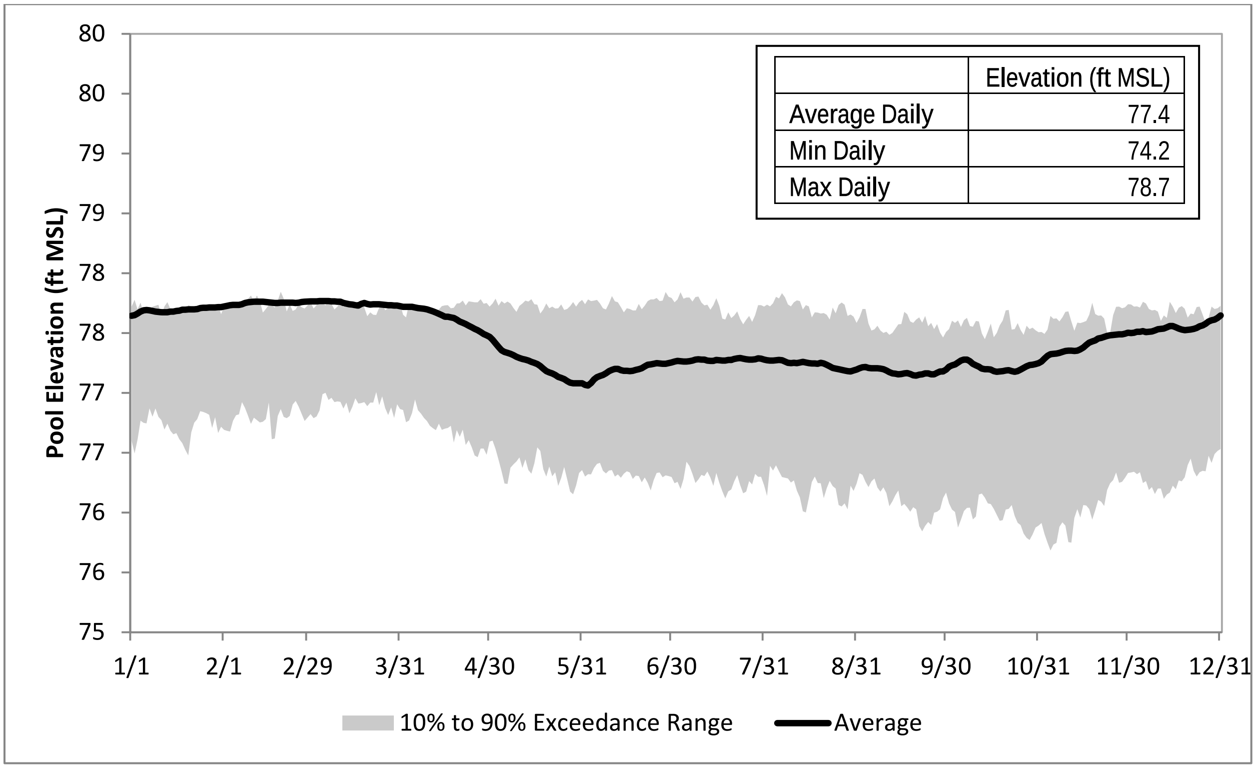
The project acts as a run-of-river facility (a reservoir project with little or no storage), and the principal purpose for this project is to provide navigable depths upstream to the Walter F. George Lock and Dam. Aside from its function to provide navigable depths, the George W. Andrews project provides for recreation and fish and wildlife conservation.

Jim Woodruff Dam and Reservoir

Jim Woodruff is a multi-purpose project constructed primarily to aid navigation in the Apalachicola River below the dam and in the Chattahoochee and Flint Rivers above the dam and to generate electric power. Secondary benefits include public recreation, regulation of stream flow, and fish and wildlife conservation.

The project has a normal pool elevation of 77 ft MSL (**Figure 3.18**). The project does not have dedicated conservation storage or flood storage but does allow for pondage of one-half foot above and below elevation 77 ft MSL to regulate flows into the reservoir from upstream projects that operate as peaking hydroelectric power generation plants. The observed record high elevation for the lake under flood conditions was elevation 78.7 ft MSL (April 1960), and the lowest level was 74.2 ft MSL (November 1978).

Figure 3.18 Jim Woodruff Average Elevation (2/1/1957–12/31/2012)



	Elevation (ft MSL)
Average Daily	77.4
Min Daily	74.2
Max Daily	78.7

3.3.2.2 Water Control Objectives

The reservoirs in the ACF River Basin are managed and operated as an integrated system of water resource projects in which each reservoir has a role to play. Many factors must be evaluated in determining project or system operation, including project requirements, time of year, weather conditions and trends, downstream needs, and the amount of water remaining in storage. The following sections describe the water control objectives and guidelines for specific project purposes.

Consumptive Demands

Water management for water supply involves taking water from storage, either directly from the pool or through releases for downstream interests. The primary concerns are that (1) sufficient drinking water will be available for urban needs and (2) agreements to provide in-stream flow for water quality will not be violated.

The year 2011 annual withdrawal and discharge data of all the permitted municipal and industrial facilities in the Georgia portion of the ACF River Basin were provided by the Georgia EPD. On January 13, 2013, the State of Georgia updated their water supply request to the Corps, Mobile District requesting a total of 705 mgd in water withdrawals from the Upper Chattahoochee River Basin (297 mgd from Lake Lanier and 408 mgd from the Chattahoochee River) to meet Georgia's projected water supply demands through 2040 (see Chapter 1 for detailed descriptions).

Municipal water systems in six counties within the Chattahoochee River watershed above the confluence with Peachtree Creek currently withdraw water from the Lake Lanier/Chattahoochee River system. The reported 2011 water withdrawals by the permit holders who rely upon the Lake Lanier/Chattahoochee River system are provided in **Table 3.8** and **Table 3.9**. The average rate of water withdrawn directly from Lake Lanier in 2011 was approximately 115 mgd. Approximately 18 mgd is withdrawn from Lake Lanier for uses in Hall County. The annual average rate of water withdrawn from the Chattahoochee River between Buford Dam and Peachtree Creek was approximately 246 mgd.

A large portion of the metropolitan Atlanta area's treated wastewater is returned to the Chattahoochee River downstream of Buford Dam and upstream of the USGS gage at Whitesburg, Georgia. In 2011, approximately an annual average of 34 mgd treated wastewater was discharged to the Chattahoochee River between Buford Dam and Peachtree Creek confluence, and approximately an annual average of 184 mgd of treated wastewater was discharged to the Chattahoochee River between Peachtree Creek confluence and the USGS Whitesburg gage. The net withdrawals are calculated by subtracting the returns from the withdrawals.

Consumptive Demand Definition

Water demands can be consumptive or non-consumptive. *Consumptive* demands involve withdrawal of water from the basin for some purpose and not returning the water, or a portion of the withdrawal directly back to the basin. Municipal, industrial, and thermal power water supply consumes a portion of the withdrawn water and returns a portion of the water back to the basin as treated wastewater. Agricultural water supply withdrawals are assumed to provide no return flows to the surface water streams in the modeling analysis for the ACF basins.

Hydroelectric power generation demand is a *non-consumptive* use of water. No water is lost from the system for hydropower generation.

Table 3.8 Water Withdrawals from Lake Lanier – 2011

County	System Name	2011 Withdrawals (mgd) Max. Monthly	Max. Daily	Annual Average
Forsyth	City of Cumming	17.5	18.8	11.6
Forsyth	Forsyth County	11.8	12.8	8.6
Gwinnett	City of Buford	1.5	1.7	1.3
Gwinnett	Gwinnett County Water & Sewerage Authority	90.9	118.8	76.1
Hall	City of Gainesville	20.7	28.5	17.6
Total				115.2

Source: **Appendix P** – State of Georgia's Water Supply Request, 2013

Table 3.9 Water Withdrawals from the Chattahoochee River below Lake Lanier – 2011

County	System Name	2011 Withdrawals (mgd) Max. Monthly	Max. Daily	Annual Average
Cobb	Cobb County Marietta Water Authority	51.9	64.8	45.1
DeKalb	DeKalb County Public Works (Water and Sewer)	84.7	114.8	72.7
Fulton	Atlanta – Fulton Water Resources Commission	54.3	69.9	38.7
Fulton	City of Atlanta	101.8	123.4	89.2
Total				245.7

Source: **Appendix P** – State of Georgia's Water Supply Request, 2013

Reservoir Discharge

Releases from reservoir projects in the river system are made to meet the minimum (capacity) needed for hydroelectric power generation or what is needed for basin-wide water quality/water supply purposes. Releases are managed using the Revised Interim Operating Plan (RIOP) for the ACF River Basin, which was implemented in June 2008. The principal water management objective under the RIOP (and any associated modifications) is to minimize adverse effects to federally listed threatened and endangered species and adverse modification of designated critical habitat in the Apalachicola River, while making allowances for increased storage opportunities and/or reductions in demand for storage to (1) provide continued support to project purposes, (2) minimize impacts to other water users, and (3) provide greater assurance of future sustained flows for federally listed species and other users during a severe multi-year drought.

Operations are governed by two basic parameters applicable to the daily releases from Jim Woodruff Dam (see **Table 3.10**): (1) a minimum discharge in relation to average basin inflows (measured as daily average in cfs) and (2) a maximum fall rate (vertical drop in river stage [ft/day]). The RIOP places limitations on refill, but it does not require a net drawdown of composite conservation storage unless basin inflow is less than 5,000 cfs. The RIOP varies minimum discharges from Jim Woodruff Dam by basin inflow and by month, and the releases are measured as a daily average flow in cfs at the Chattahoochee gage.

The RIOP includes a drought contingency operation (referred to as a drought operation). The drought operation plan specifies a minimum release from Jim Woodruff Dam and temporarily suspends the other minimum release and maximum fall rate provisions until composite conservation storage within the basin is replenished to a level that can support them. Under the drought plan, minimum discharge is determined in relation to the composite conservation storage of all federal reservoirs and not the average basin inflow. The drought plan includes the option for a temporary waiver from the existing water control plan.

Once the composite conservation system storage falls below a specific level in the RIOP, the minimum release from Jim Woodruff Dam is 4,500 cfs, and all basin inflow above 4,500 cfs that is capable of being stored may be stored. During the drought contingency operations, a monthly monitoring plan is implemented to track composite conservation storage, determine water management operations (the first day of each month represents a decision point), and determine which operational triggers are applied. In addition, recent climatic and hydrological conditions experienced and meteorological forecasts are used when determining the set of operations in the upcoming month.

During the sturgeon spawning season, the composite conservation storage is monitored daily to determine water management operations. The Corps uses recent climatic and hydrologic conditions and meteorological forecasts, in addition to composite conservation storage values, to determine the appropriate basin inflow thresholds in support of water management operations.

Table 3.10 Summary of Daily Discharge from Jim Woodruff in the ACF River Basin (cfs)

Description	Jim Woodruff Discharge
Average Daily	20,457
Target Discharge	5,000
Target Discharge – Drought Operations	4,500
Minimum Daily (cfs)	4,082
Maximum Daily Flow (cfs)	228,868

Note: Based on Corps reservoir records from Mobile District (1976–2012).

Hydropower

Most of the federal and non-federal dams in the ACF River Basin have hydroelectric power generating capability (**Table 3.11**). Hydroelectric power generation dams convert the force of falling water into electrical power. Although not the primary source of energy in the United States, hydroelectric power generation is still an important source of electricity; it can be started quickly to meet immediate needs and it is both a renewable and clean source of energy. Much of the hydroelectric power generation in the ACF River Basin is *peaking* power; the generators operate when there is the most, or *peak,* demand for power. Air-conditioning and heating uses often cause the peak demand for power, so the hydroelectric power generation releases are usually made when temperatures are extreme.

Each project generally provides a minimum of 2 hours of generation a day for 5 days a week at powerhouse capacity throughout the year. This minimum generation provides the release that would normally meet downstream water supply and water quality demands. Minimum releases may also be increased if local inflows below the project are insufficient to meet water quality/water supply requirements. Additional generation solely to meet system hydroelectric power generation demands does not occur.

Table 3.11 Summary of Average Daily Hydropower Production

Description	Buford Dam[1]	West Point Dam[2]	Walter F. George Dam[3]	Jim Woodruff Dam[4]
Average Daily Elevation Head (Lake Elevation – Tailwater Elevation)(feet)	154.45	72.1	83.6	30.2
Average Daily Energy (MWh)	351.7	596.0	1,319.0	649.0
Turbine Discharge (cfs)	N/A	4,247.0	8,438.0	12,945.0

Notes:
MWh = megawatt-hour
[1] Period of Record – 5/1/1959 to 9/30/2010
[2] Period of Record – 5/9/1975 to 9/30/2010
[3] Period of Record – 12/3/1963 to 9/30/2010
[4] Period of Record – 2/1/1957 to 9/30/2010
[5] Record only from – 5/1/1959 to 12/31/1982

Recreation

All the major federal reservoirs have become important recreational resources in the ACF region, resulting in a large economic expansion based on local and interstate tourism. A wide variety of recreational opportunities, dependent upon or enhanced by the presence of the lakes, are provided at these sites, including boating, fishing, picnicking, sightseeing, skiing, and camping.

For recreation, reservoirs are managed to maintain a steady pool at as high a level as possible while consistent with other authorized purposes, particularly during the primary recreation season of May through early September. To sustain optimal recreational use of all the ACF River Basin projects in light of other project purposes, drawdown levels and rates are balanced among the reservoirs. To maintain reasonable access to the reservoir as long as possible, drawdowns are performed at as steady a rate as possible.

For Lake Lanier, West Point Lake, and Walter F. George Lake, certain levels were identified in each impoundment at which recreation would be affected (**Table 3.12**):

- *Initial Impact Level* (IIL) – the level at which recreation impacts are first observed (i.e., some boat launching ramps are unusable, most beaches are unusable or minimally usable, and navigation hazards begin to surface)
- *Recreation Impact Level* (RIL) – the level at which major impacts on concessionaires and recreation are observed (more ramps are not usable, all beaches are unusable, boats begin having problems maneuvering in and out of marina basin areas, loss of retail business occurs)

- *Water Access Limited Level* (WAL) – the level at which severe impacts are observed in all aspects of recreational activities; at this point, all or almost all boat ramps are out of service, all swimming beaches are unusable, major navigation hazards occur, channels to marinas are impassable and/or wet slips must be relocated, and a majority of private boat docks are unusable

Table 3.12 Recreation Impact Levels (ft MSL)

Project	Initial Impact Level (IIL)	Recreation Impact Level (RIL)	Water Access Limited (WAL)
Lake Sidney Lanier	1,066.0	1,063.0	1,060.0
West Point Lake	632.5	629.0	627.0
Lake Walter F. George	187.0	185.0	184.0

Recognizing that pool levels are affected as the projects are managed to meet other purposes, pools are managed as close to the top of the conservation pool as possible. The impacts to recreation levels are tracked on an annual basis, and once the RIL is reached in a given year, it is counted for that year; subsequent pool impacts within that year are not counted as additional impacts. The number of times the pool level has dropped below a recreation level for the period of record up to December 31, 2012, is recorded in **Table 3.13**. The West Point Lake has historically had the most impact to the recreation levels.

Table 3.13 Number of Times the Water Surface Level Drops Below the Reservoir Recreation Levels

	Buford[1]	West Point[2]	Walter F. George[3]
Initial Impact Level (IIL)	51	38	45
Recreation Impact Level (RIL)	40	38	33
Water Access Limited Level (WAL)	27	29	5

[1] Period of Record – 2/8/1956 to 12/31/2012
[2] Period of Record – 5/9/1975 to 12/31/2012
[3] Period of Record – 3/13/1963 to 12/31/2012

Navigation

Although navigation is an authorized purpose of the federal projects in the ACF River Basin, they are not being operated to achieve substantial navigation benefits. This is principally due to a lack of commercial navigation use and the inability of the Corps, Mobile District to secure the necessary water quality certification from the Florida Department of Environmental Protection to perform the required maintenance dredging and other operational activities for the navigation channel downstream of Jim Woodruff Dam, as previously discussed. Limited use of special releases to assist with critical navigation requirements (in the form of a brief navigation window) have been addressed on a case-by-case basis. Such special releases are coordinated with Florida, Alabama, and Georgia; federal resource agencies; and key stakeholders.

Flood Control/Flood Damage Reduction Operations

The objective of flood damage reduction operations (formerly referred to as flood control) is to impound excess flows, thereby reducing downstream river levels below flood stage. Whenever flood conditions occur, operation for flood damage reduction takes precedence over all other project functions. Only Buford and West Point dams have storage allocated for flood damage reduction operations. During the principal flood season, December through April, the regulation plan at Walter F. George Lake provides for lower lake levels to ensure lower peak stages throughout the reservoir during major floods. George W. Andrews and Jim Woodruff dams operate to pass inflows.

3.3.3 Water Quality

This section provides a review of existing surface water quality, including water use classification and standards, permitted discharges, and a summary of Georgia 2012 305(b)/303(d) List of Waters.

3.3.3.1 Existing Water Use Classification and Standards

The length of the Chattahoochee River that runs from the confluence of White Creek to the confluence of Mud Creek has a designated use of "recreation." The recreational use is defined in 391-3-6-.03 as, "[g]eneral recreational activities such as waterskiing, boating, and swimming, or for any other use requiring water of a lower quality, such as recreational fishing." The designated use for the Chattahoochee River below the Mud Creek confluence to Buford Dam (including Lake Lanier) is classified as "recreation" and "drinking water." **Table 3.14** summarizes the specific water use classification for the segments of the Upper Chattahoochee River from White Creek to Buford Dam. The Chattahoochee River Basin has designated primary and secondary trout streams upstream from the proposed raw water intakes in White and Habersham counties, but there are no designated trout streams in Hall County.

Table 3.14 Water Use Classification – Upper Chattahoochee River (Headwater to Lake Lanier)

River	River Segment	Classification
Chattahoochee River	White Creek to Mud Creek	Recreation
Chattahoochee River/Lake Lanier	Mud Creek to Buford Dam	Recreation and Drinking Water

Source: Chapter 391-3-6-.03 of the Rules and Regulations for Water Quality Control, Section 14, see Attachment 7 for Upper Chattahoochee Trout Streams

Table 3.15 summarizes the water quality criteria adopted by Georgia for supporting the recreational designated use. **Table 3.16** summarizes the criteria adopted to support the designated use as drinking water supplies. Waterbodies that do not meet the water quality criteria are identified by states as impaired under section 303(d) of the Clean Water Act (CWA). **Table 3.17** shows the site-specific water quality criteria adopted for locations within the ACF basin.

Table 3.15 Water Quality Criteria for Recreation Designated Use[1, 2]

Parameter	Criteria
Fecal Coliform	< 200 colonies/100 milliliters (mL) as a geometric mean (geometric means based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours). Should water quality and sanitary studies show natural fecal coliform levels exceed 200/100 mL (geometric mean) occasionally in high quality recreational waters, then the allowable geometric mean fecal coliform level shall not exceed 300 per 100 mL in lakes and reservoirs and 500 per 100 mL in free flowing fresh water streams.
DO	For waters supporting warm water species of fish[2]: 5 mg/L daily average, and no less than 4 mg/L at all times
pH	6.0 - 8.5
Temperature	< 90 degrees Fahrenheit (°F). At no time is the temperature of the receiving waters to be increased more than 5°F above intake temperature except that in estuarine waters the increase will not be more than 1.5°F.

Notes:
DO = Dissolved Oxygen
[1] Source: Georgia Rule 391-3-6-.03 Water Use Classifications and Water Quality Standards
[2] No streams in Hall County are designated as trout streams (based on Rule 391-3-6-.03).

Table 3.16 Water Quality Criteria for Drinking Water Supply Designated Use[1, 2]

Parameter	Criteria
Fecal Coliform	For the months of May through October, when water contact recreation activities are expected to occur, fecal coliform not to exceed a geometric mean of 200 per 100 mL based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours. Should water quality and sanitary studies show fecal coliform levels from non-human sources exceed 200/100 mL (geometric mean) occasionally, then the allowable geometric mean fecal coliform shall not exceed 300 per 100 mL in lakes and reservoirs and 500 per 100 mL in free flowing freshwater streams. For the months of November through April, fecal coliform not to exceed a geometric mean of 1,000 per 100 mL based on at least four samples collected from a given sampling site over a 30-day period at intervals not less than 24 hours and not to exceed a maximum of 4,000 per 100 mL for any sample. The State does not encourage swimming in surface waters since a number of factors which are beyond the control of any State regulatory agency contribute to elevated levels of fecal coliform.
DO	For waters supporting warm water species of fish2: 5 mg/L daily average, and no less than 4 mg/L at all times
pH	6.0 - 8.5
Temperature	< 90°F. At no time is the temperature of the receiving waters to be increased more than 5°F above intake temperature except that in estuarine waters the increase will not be more than 1.5°F.

Notes:
DO = Dissolved Oxygen
[1] Source: Georgia Rule 391-3-6-.03 Water Use Classifications and Water Quality Standards
[2] No streams in Hall County are designated as trout streams (based on Rule 391-3-6-.03).

Table 3.17 Site-specific Standards in Georgia and Alabama in the ACF Basin[1]

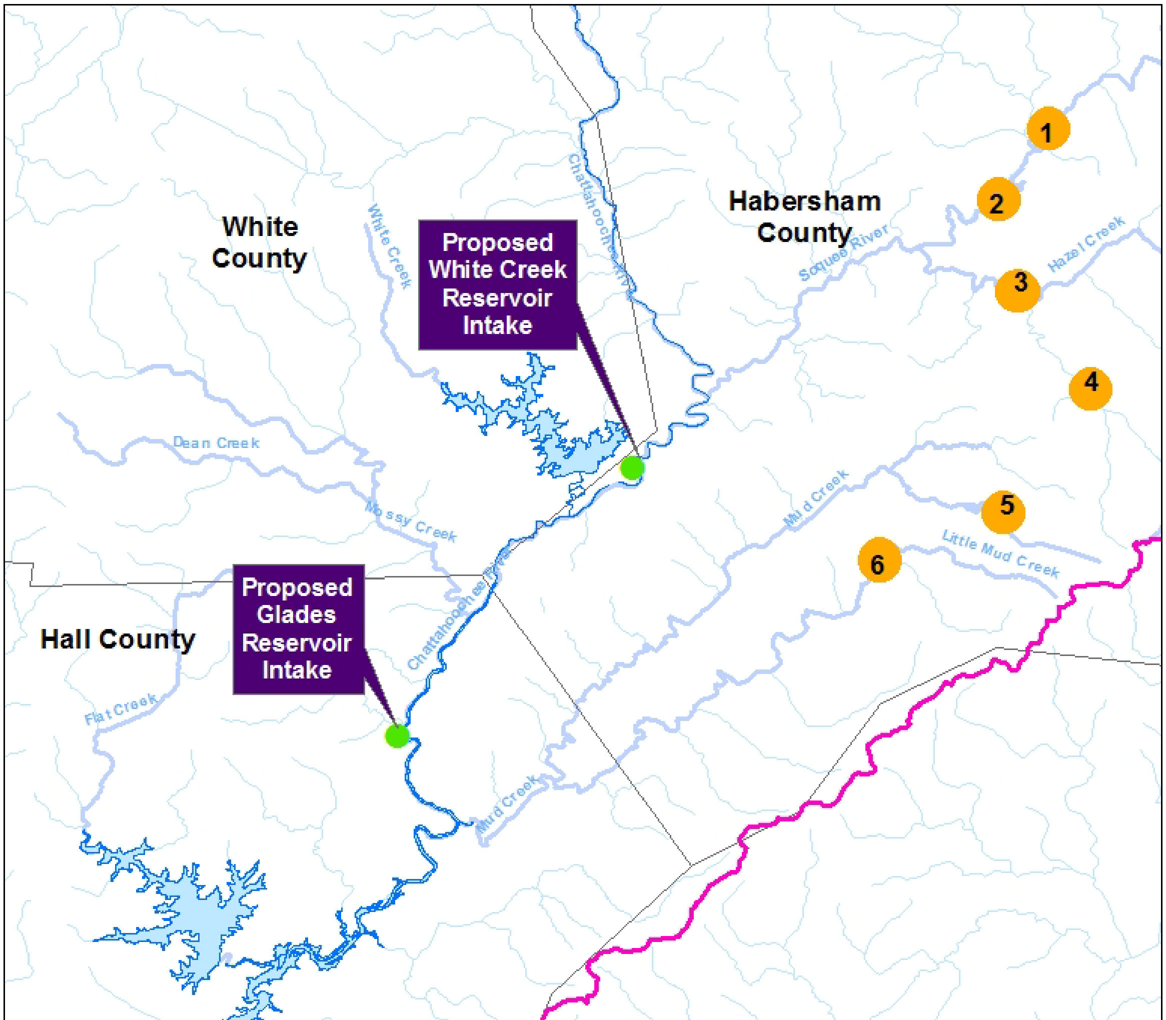
State	Waterbody Name	Chlorophyll *a*	Other
Proposed Glades Reservoir Impact Area			
Georgia	Lake Sidney Lanier Tributaries		Annual total phosphorus loading: Not to exceed 178,000 lbs at the Chattahoochee River at Belton Bridge Road, 118,000 lbs at the Chestatee River at GA Hwy 400, and 14,400 lbs at Flat Creek at McEver Road
Georgia	Lake Sidney Lanier	April – October: average of monthly samples not to exceed 5 µg/L upstream of Buford Dam forebay, 6 µg/L upstream from Flowery Branch confluence, 7 µg/L at Browns Bridge Rd, 10 µg/L at Bolling Bridge on the Chestatee River, and 10 µg/L at Lanier Bridge on the Chattahoochee River more than once in five years.	pH: 6.0 – 9.5
			Total nitrogen: Not to exceed 4 mg/L as nitrogen in the photic zone
			Phosphorus: total lake loading not to exceed 0.25 lb/ac-ft of lake volume per volume/year
			Fecal coliform: Apply “Recreation” criteria (see Table 3)
			DO: 5.0 mg/L daily average, and no less than 4.0 mg/L at all times
			Termperature: Apply “Recreation” criteria (see Table 3)
Remaining ACF Basin			
Georgia	West Point Lake Tributaries		Annual total phosphorus loading: Not to exceed 11,000 lbs at Yellow Jacket Creek at Hammet Road, 14,000 lbs at New River at Hwy 100, and 1,400,000 lbs at Chattahoochee River at U.S. 27
Georgia/ Alabama	West Point Lake	April - October: average of monthly samples not to exceed 24 µg/L at the LaGrange Water Intake and 22 µg/L upstream from Dam in the Forebay more than once in five years	pH: 6.0 - 9.5
			Total nitrogen: Not to exceed 4 mg/L as nitrogen in the photic zone
			Phosphorus: Total lake loading not to exceed 2.4 lb/acre-foot of lake volume per year
			Fecal coliform: Apply “Fishing” criterion from US 27 at Franklin to New River, and “Recreation” criterion from New River to West Point Dam (see Table 3)
			DO: 5.0 mg/L daily average, and no less than 4.0 mg/L at all times
			Temperature: Apply “Recreation” criteria (see Table 3)
Georgia	Walter F. George Lake Tributaries		Annual total phosphorus loading: monitored at Chattahoochee River at Hwy 39, and not to exceed 2,000,000 lb
Georgia/ Alabama	Walter F. George Lake	April – October: average of monthly samples not to exceed 18 µg/L at mid-river at U.S. Hwy 82 or 15 µg/L at mid-river in the dam forebay more than once in five years	pH: 6.0 - 9.5
			Total nitrogen: Not to exceed 3 mg/L as nitrogen in the photic zone
			Phosphorus: Total lake loading not to exceed 2.4 lb/acre-foot of lake volume per year
			Fecal coliform: Apply “Fishing” criterion from GA Hwy 39 to Cowikee Creek, and “Recreation” criterion from Cowikee Creek to Walter F. George Dam (see Table 3)
			DO: No less than 5.0 mg/L daily average, and no less than 4.0 mg/L at all times
			Temperature: Apply “Recreation” criteria (see Table 3)

Notes:
DO = Dissolved Oxygen
[1] Source: Georgia Rule 391-3-6-.03 Water Use Classifications and Water Quality Standards

3.3.3.2 Permitted Discharges

There are four permitted facilities upstream of the proposed raw water intake location. **Figure 3.19** shows the existing permitted discharge facilities and their permitted flow limits.

Figure 3.19 Existing Permitted Discharges



	Facility Name	NPDES ID	Permitted Flow (mgd)	Receiving Stream
1	Clarkesville WPCP	GA0032514	0.75	Soquee River
2	Scovill Fasteners Inc.	GA0001112	0.1893	Soquee River
3	Demorest WPCP	GA0032506	0.4	Hazel Cr Tributary
4	Habersham Central High School	GA0033952	0.018	Hazel Cr Tributary
5	Cornelia WPCP	GA0021504	3	S. Fork Little Mud Cr
6	Baldwin WPCP	GA0033243	0.3	Little Mud Cr

Note: Facilities 1 through 4 discharge above the proposed water intakes. Facilties 5 and 6 discharge below the proposed water intakes.

Note: These are the only dischargers in the Upper Chattahoochee River Basin (above proposed intake), per Georgia EPD Permit records.

3.3.3.3 Georgia 2012 305(b)/303(d) List of Waters

Section 305(b) of the CWA requires States to assess and describe the quality of its waters every two years in a report called the 305(b) report. Section 303(d) of the CWA requires states to submit a list of all of the waters that are not meeting their designated uses and requires the development of a total maximum daily load (TMDL). The 303(d) list is also to be submitted every two years. Georgia submits a combined 305(b)/303(d) report called an Integrated Report (also referred to as “Water Quality in Georgia”). One section of the Integrated Report is the 305(b)/303(d) list of waters, which contains a list of all of the waters that the State has assessed. The most recent list was published in 2012 by Georgia and was approved by the U.S. Environmental Protection Agency (EPA) in May 2013. Additional information on the 305(b)/303(d) list of waters and the EPA approval letter can be found on http://www.gaepd.org/Documents/305b.html.

The Georgia EPD determines whether a waterbody is supporting its designated uses by collecting water quality data and comparing this data against the water quality criteria. If it is determined that a waterbody is not supporting its designated use, then the Georgia EPD will typically develop a TMDL as the start of the process of restoring the water. A TMDL determines how much of a particular pollutant a waterbody can contain and still support its designated use. The TMDL will state how much the pollutant load to the water needs to be reduced in order for the water to support its designated use.

Based on the 2012 Integrated Report, the section of the Chattahoochee River below the proposed intakes and above Lake Lanier supports its current designated use; however, the Chattahoochee River is listed for fecal coliform impairments upstream of the proposed intake. Additionally, fecal coliform and occasional biota impairments have been observed in segments of the tributaries to the Chattahoochee River, including Flat Creek, Little Mud Creek, Mud Creek, and White Creek. A summary of listing status for the 187 miles of streams monitored in the Upper Chattahoochee River watershed above Lake Lanier is provided in **Table 3.18**. The stream segments monitored are most commonly evaluated for Dissolved Oxygen (DO), Temperature, Biota, and Fecal Coliform. All segments may not be actively monitored for all constituents.

Table 3.18 Summary of 2012 305(b)/303(d) Listing Status for Streams in the Upper Chattahoochee River Watershed[1, 2]

Parameter	Summary
DO	0 reaches (0 miles) is listed as impaired
Temperature	0 reaches (0 miles) is listed as impaired
Biota Fish	7 reaches (74 miles) are listed as impaired due to non-point source pollution
Biota Macroinvertebrates	2 reaches (11 miles) are listed as impaired due to non-point source pollution
Fecal Coliform	9 reaches (70 miles) are listed as impaired due to non-point source pollution
TCA2	1 reach (1 mile) is listed as impaired due to an industrial contributor

Notes:
DO = Dissolved Oxygen
[1] Source: Georgia EPD 305(b)/303(d) List (2012) for Upper Chattahoochee watershed (Hall, Habersham, and White counties)
[2] TCA (1,1,2-trichloroethane) is a constituent not typically monitored, but data provided from the Georgia EPD's Hazardous Waste Branch led to this stream listing.

Many of the permitted discharges in the Upper Chattahoochee River Watershed are into the tributaries of the Chattahoochee River, and significant dilution is provided as the tributaries enter the main stem of the river. In general, point sources are not the cause of most fecal coliform and biota impacted impairments. Non-point sources or urban runoff have been identified as the potential sources for the fecal coliform or biota impairments.

3.3.4 Floodplains

Executive Order (EO) 11988, *Floodplain Management*, requires federal agencies to “avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood hazards” and “reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains” (FedCenter, 2012). All federal actions are required to meet the conditions of this EO.

The Special Flood Hazard Area (SFHA) is the area that would be inundated by the base flood (also referred to as the 100-year flood), or a flood having a 1% chance of being equaled or exceeded in any year (44 CFR 9.4). The base flood designates the “minimum level of flooding to be used by a community in its floodplain management regulations” (44 CFR 9.4). The Federal Emergency Management Agency (FEMA) is tasked with operating the National Flood Insurance Program (NFIP), which offers insurance to property owners to protect against damage caused by flooding events. Participation in the NFIP is voluntary for communities. Those communities that choose not to participate are exempt from the requirements of the NFIP, but federal flood insurance would not be available to the people that live within that community.

Due to the potential to adversely affect downstream property owners, development or construction within the SFHA is limited in the participating communities.

3.3.4.1 FEMA Flood Zones

A large portion of the land that would be impounded by the potential Glades Reservoir site is located in a Zone A flood zone, which is defined as an “area of special flood hazard without water surface elevations determined” (44 CFR 64.3). FEMA 265 states that, “although BFEs are not provided, the community is still responsible for ensuring that new development within approximate Zone A areas is constructed using methods that will minimize flood damages.” The FEMA flood zones for the Glades Reservoir are shown on **Figure 3.20**.

The White Creek alternative would impound an area that includes both Zone A flood zones and Zone AE flood zones. Zone AE is defined by FEMA as an “[a]rea of special flood hazard with water surface elevations determined” (44 CFR 64.3). The water surface elevation, otherwise known as the base flood elevation (BFE) is shown on the Flood Insurance Rate Maps (FIRMs) for a community. The area that would be impounded by the potential White Creek Reservoir spans the BFEs of approximately 1164 ft MSL at the proposed location of the White Creek Dam and 1317 ft MSL at the northern most boundary of the proposed footprint of the reservoir located within the Zone AE area. The portion of the footprint that is located within the Zone A area has no current calculated BFE. The FEMA flood zones for the White Creek Reservoir are shown on **Figure 3.21**.

Figure 3.20 FEMA Flood Zones for the Glades Reservoir

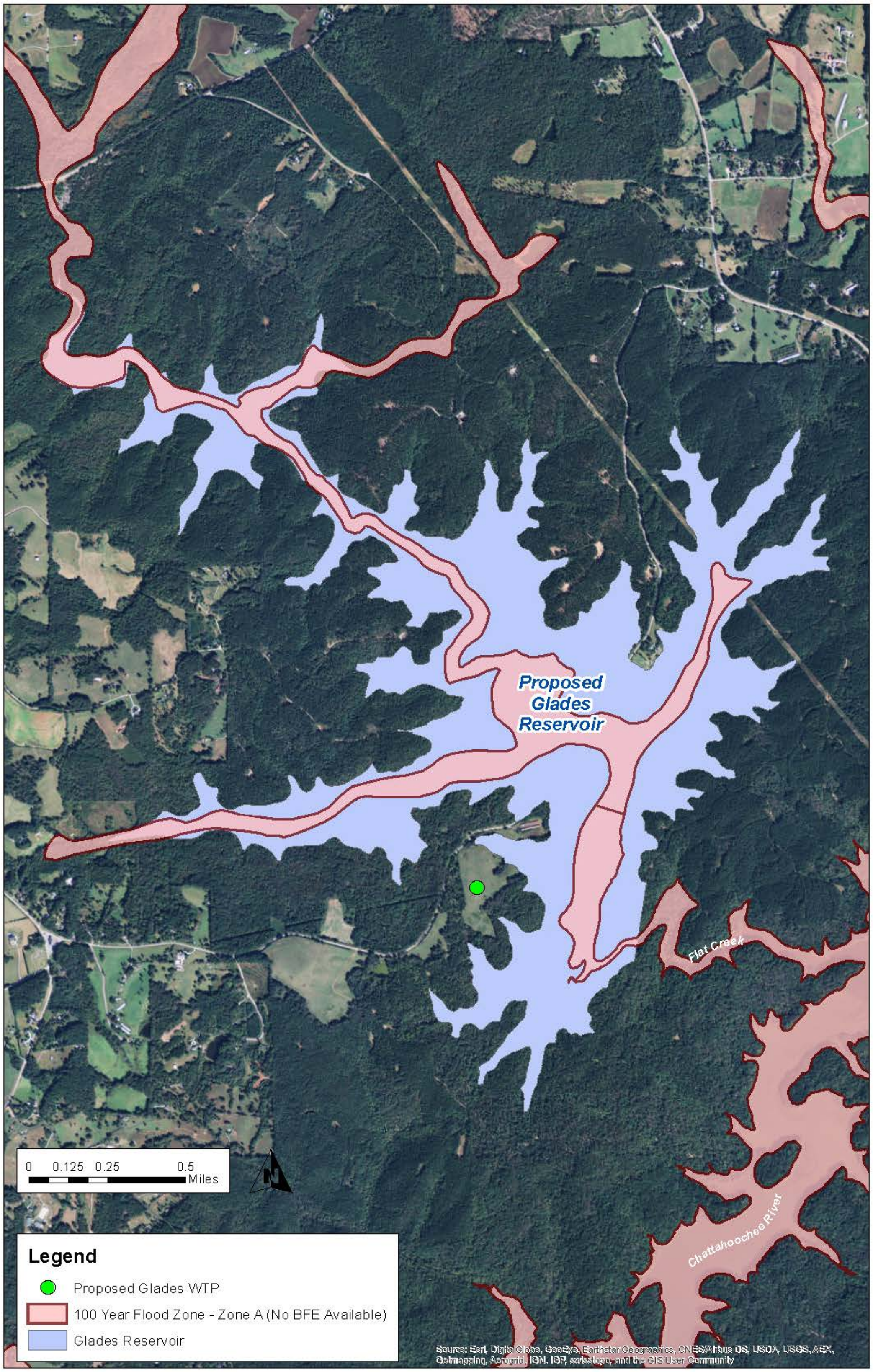
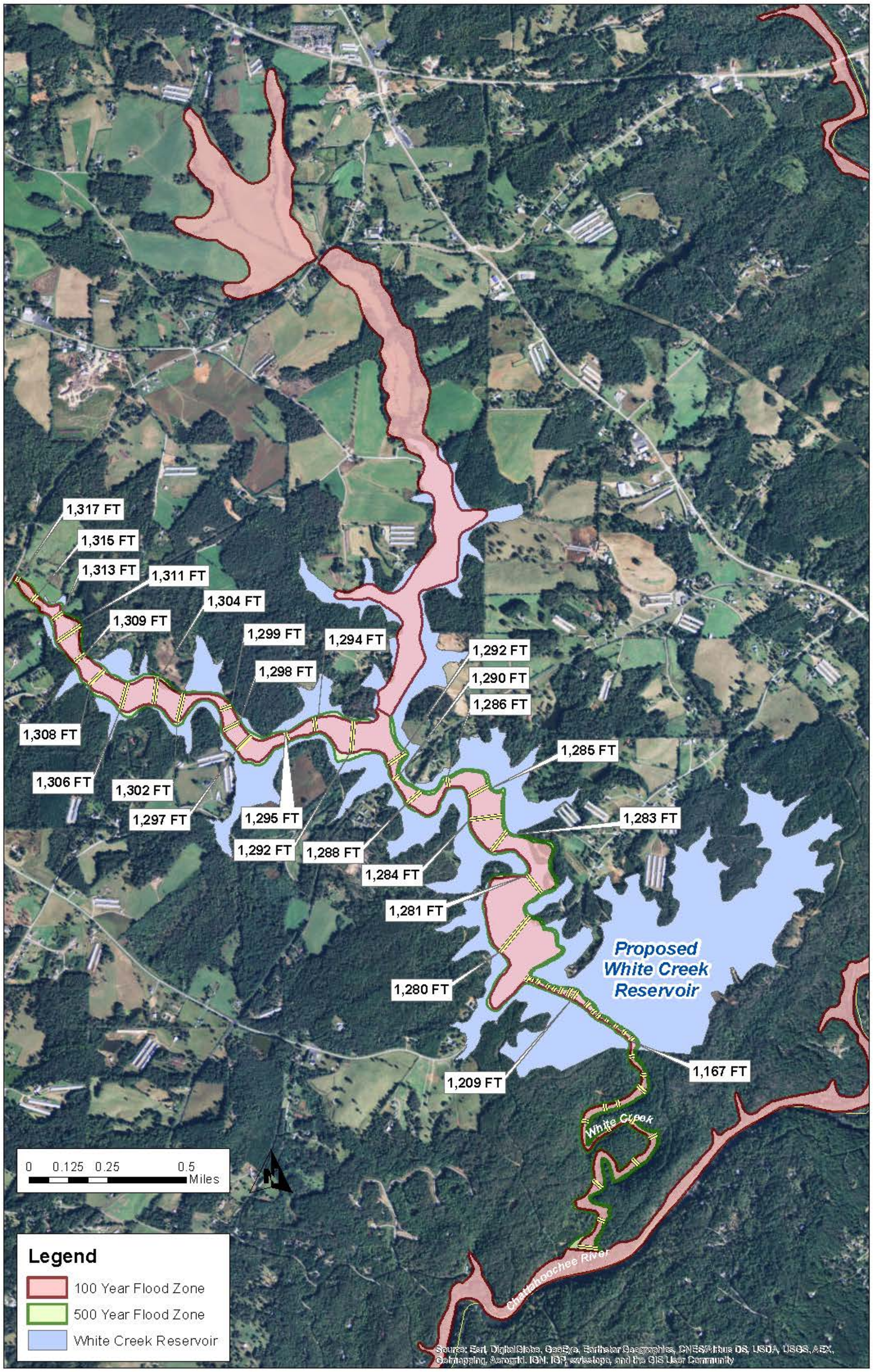


Figure 3.21 FEMA Flood Zones for the White Creek Reservoir



3.3.5 Groundwater

The 404 permit application for Glades Reservoir submitted by Hall County (the Applicant) in June 2011 (Permit Application SAS-2007-00388) cited an estimated current groundwater use of 3.5 million gallons per day (mgd). In the application, Hall County predicted a decline in groundwater use by 2060. The Applicant estimated that its total groundwater use will be approximately 2 mgd in year 2060 (Permit Application Number SAS-2007-00388).

Historically, groundwater use has been low compared to surface water use in Hall County. Surface water has been Hall County's primary water supply source since the City of Gainesville Public Utilities Department (GPUD) constructed the Riverside Water Treatment Plant (WTP) in 1953 to provide treatment for water withdrawn from Lake Lanier. In addition to Lake Lanier, Cedar Creek Reservoir was constructed in 2005 to provide additional future surface water supply in the portion of Hall County located in the North Oconee River basin.

Groundwater provides the primary public water supply source for the cities of Lula and Flowery Branch in Hall County. Groundwater is also used as a water supply source for several private industries, single-family residences, small community water systems, golf course irrigation, and limited agricultural activities in Hall County.

This section reviews geology and aquifer in the affected area and provides a summary of existing groundwater use, groundwater withdrawal permits, and availability.

3.3.5.1 Geology and Aquifer

Hall County is located north of the Fall Line in the Piedmont physiographic province of Georgia as shown in **Figure 3.22**. The geology in this area is complex and consists of structurally deformed metamorphic and igneous rocks (Peck et al., 2011). The bedrock underlying this area is mostly crystalline rock and the aquifers are referred to as "crystalline-rock aquifers." Crystalline rocks have limited primary pore spaces, and the porosity and permeability of the unweathered and unfractured bedrock is extremely low. The primary means of groundwater transmission is through secondary openings along fractures, foliation, joints, contacts, or other features in the crystalline-rock bedrock.

The average reported yield for wells constructed in the crystalline-rock aquifers located within the Piedmont physiographic province is generally in the range of 15 to 20 gallons per minute (gpm) (USGS, 1990). Variation in yield depends on permeability and thickness of overlying soils and properties of the bedrock in which the well is installed (Donahue, 2002). Wells developed within the crystalline-rock aquifer are generally suitable for rural single-family residential use.

The March 2010 draft *Synopsis Report on Groundwater Availability Assessment* (Georgia State-Wide Water Management Plan, 2010) estimates that the area normalized sustainable yield for the crystalline-rock aquifer in the Piedmont region ranges from 0.010 to 0.049 mgd/square mile (mi^2).

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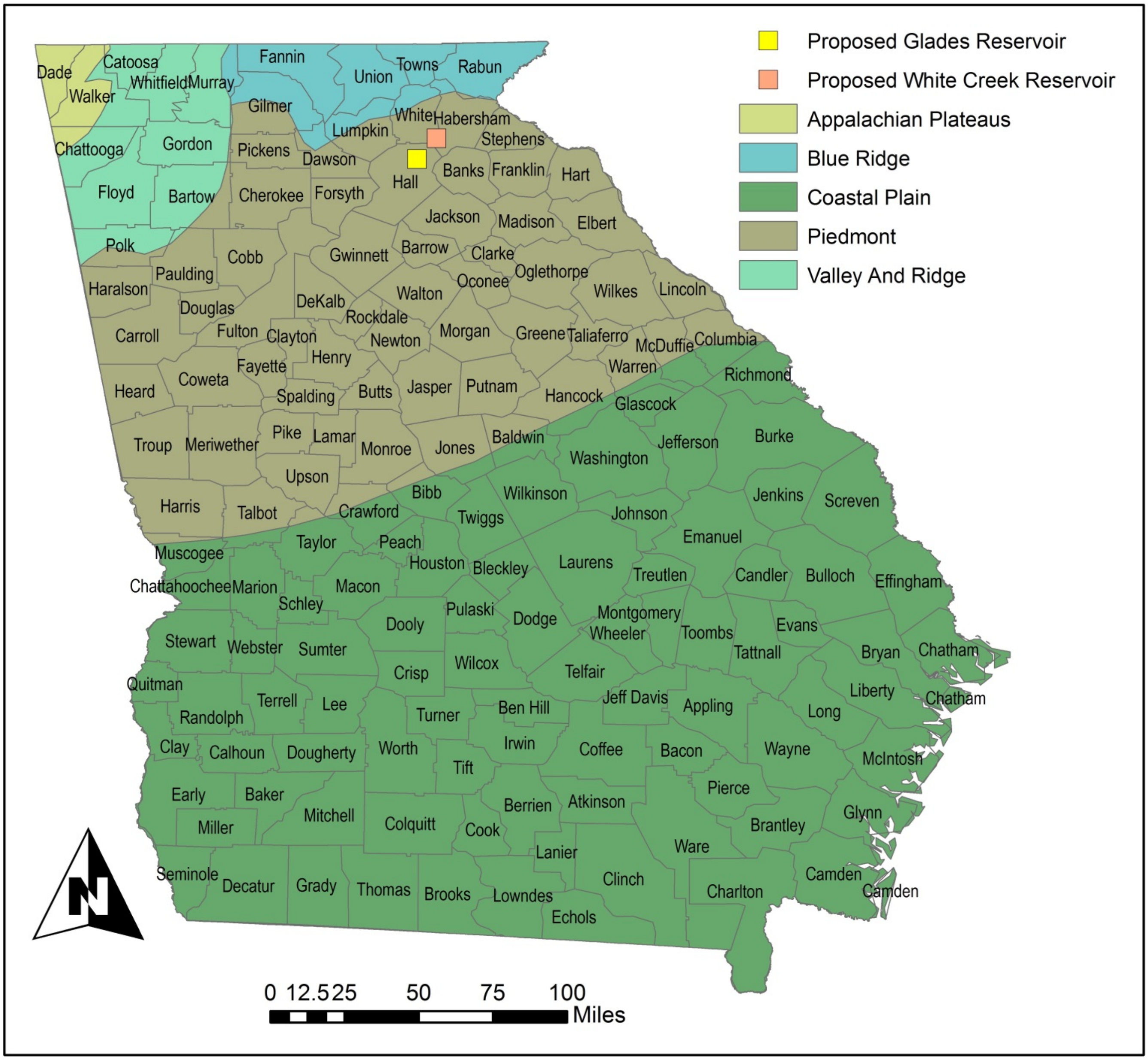
Figure 3.22 Hydrogeologic Provinces of Georgia



3.3.5.2 Existing Groundwater Use

The U.S. Geological Survey (USGS), in cooperation with the Georgia EPD, compiles water use estimates for Georgia every five years. The most recent compilation was published in the report *Water Use in Georgia by County in 2005: Water Use Trends 1980 to 2005* (Fanning et.al, 2009*)*. The report presents water use estimates from surface and groundwater sources for selected water use categories. Groundwater use was estimated to be approximately 4.18 mgd, or 18% of the total (23.71 mgd) water supply, in 2005 in Hall County. The USGS reported that data compilation for the year 2010 is not yet available. Report completion and data availability for 2010 is not expected until 2014. **Table 3.19** summarizes the groundwater use by various categories as presented in the USGS report.

Table 3.19 2005 Groundwater Use in Hall County[1]

Type	2005 Withdrawals (mgd)
Public Supply[2]	0.51
Domestic & Commercial[3]	2.18
Industrial & Mining[4]	1.40
Irrigation[5]	0.09
Total	4.18

[1] Source: *Water Use in Georgia by County in 2005: Water Use Trends 1980 to 2005* (Fanning et.al, 2009), USGS, Scientific Investigation Report 2009-5002.
[2] Public supply includes City of Flowery Branch and City of Lula and additional community water systems.
[3] Represents self-supplied domestic and commercial water use from private wells. USGS estimated domestic and commercial water use based on a per capita water use of 75 gallons per capita per day (gpcd).
[4] Represents the groundwater use by manufacturing and mining industries. Major industrial use in Hall County is by the food/poultry industry.
[5] Represents the groundwater used for crops, large nurseries, athletic fields, and golf courses.

Since more recent USGS data was not available, the Metropolitan North Georgia Water Planning District's *Water Metrics Report* (February 2011) was also reviewed. **Table 3.19** provides a summary of average groundwater withdrawals, as provided in this report, by major public and industrial users in Hall County for the years 2000–2012. The reported annual average withdrawals by the major public and industrial users ranged from 0.59 to 1.11 mgd in the 12-year period of 2000–2012, with the lowest withdrawals reported during the 2008–2009 drought period. These figures do not include private residential or commercial wells or irrigation systems that are included in the USGS estimates.

Self-service single-family residences are not required to get a state groundwater withdrawal permit or report their groundwater use. For the purpose of this EIS, the self-service single-family residences were estimated by subtracting the total number of single-family accounts reported for 2010 by the GPUD from the total single-family dwelling units reported in the 2010 Census for Hall County. Using the above calculation, an estimated 13,423 households currently use self-supplied groundwater. Assuming an average use of 180 gallons per day per household (62 gallons per capita per day based on an average household size of 2.91 persons per household), this equates to approximately 2.4 mgd of self-supplied groundwater use in Hall County in 2010.

3.3.5.3 Permitted Withdrawals

A water withdrawal permit is required in Georgia for withdrawals of 100,000 gallons per day (gpd) or greater. Average groundwater use for major Public and Industrial Users in Hall County is shown in **Table 3.20**. The Georgia EPD, Watershed Protection Branch currently issues groundwater withdrawal permits under two categories: non-farm use and farm use.

Table 3.20 Average Groundwater Withdrawal by Major Public and Industrial Users in Hall County (2000–2009)[1]

Year	City of Flowery Branch (mgd)	City of Lula (mgd)	Industries[2] (mgd)	Total[3] (mgd)
2000[1]	0.14	0.15	0.71	1.00
2001[1]	0.17	0.16	0.69	1.02
2002[1]	0.16	0.16	0.53	0.85
2003[1]	0.17	0.17	0.37	0.71
2004[1]	0.17	0.18	0.44	0.79
2005[1]	0.20	0.20	0.65	1.05
2006[1]	0.20	0.22	0.69	1.11
2007[1]	0.21	0.20	0.42	0.83
2008[1]	0.20	0.19	0.20	0.59
2009[1]	0.22	0.19	0.31	0.72
2010[4]	0.24	0.19	0.30	0.73
2011[4]	0.21	0.17	0.52	0.90
2012[4]	0.28	0.16	0.40	0.84

[1] Source: Metropolitan North Georgia Water Planning District, Water Metrics Report (February 2011).
[2] Fieldale Farms Corp. and Pilgrim's Pride Corp of Delaware.
[3] Total for major public and industrial users only, does not include private residential, commercial and irrigation uses.
[4] Source: Georgia EPD file review of each permittee's monthly reporting records (October 2013).

The non-farm permits include both municipal and industrial users. **Table 3.21** provides a list of current non-farm permits (as of March 2011). Current industrial users include two poultry operations in Hall County. The total permitted withdrawal under non-farm permits is 2.70 mgd on a monthly average basis. Actual groundwater use for these permittees in 2012 was only about 0.74 mgd based on the monthly withdrawal records submitted by each permittee to Georgia EPD.

Table 3.21 Groundwater Withdrawal Permits for Non-Farm Use in Hall County

Aquifer	Permit Number	Permit Holder	Permit Limit Yearly/Monthly Average (mgd)[1]	Reported 2012 Average Use (mgd)[2]
Crystalline Rock	069-0002	Fieldale Farms Corp	1.20	0.24
Crystalline Rock	069-0003	City of Flowery Branch	0.70	0.28
Crystalline Rock	069-0004	Pilgrim's Pride Corporation of Delaware	0.30	0.06
Crystalline Rock	069-0005	City of Lula	0.50	0.16
Crystalline Rock	A08-069-0016	Reunion Golf Club	130.0	0.19
Crystalline Rock	A08-069-0017	Reunion Golf Club	230.0	0.33
Crystalline Rock	A01-069-0013	Lanier Village Estates Inc.	70.0	0.10
Crystalline Rock	A01-069-0014	Lanier Village Estates Inc.	45.0	0.07
		Total	477.7	1.43

[1] Georgia EPD Non-Farm Groundwater Withdrawal Permits (Revised May 2013) http://www.gaepd.org/Documents/regcomm_wpb.html

[2] Reported Annual Average Use (mgd), obtained during a Georgia EPD file review of each permittee's monthly reporting records (October 2013)

In addition to the above active permits, a wellhead protection application was submitted to the Georgia EPD in early 2013 by the Lake Lanier Island Development Authority. The application was for a withdrawal rate of 500,000 gpd (or 350 gpm). This well would be considered as a future groundwater source in Hall County.

Table 3.22 summarizes the current permits (as of January 2011) for farm use. The farm use permit is issued based on the capacity of the irrigation pump in gpm and not based on an annual or monthly permitted withdrawal quantity. The total permitted rate is 1,000 gpm (or 1.44 mgd) based on the existing permits. Farm permittees are not required to report monthly groundwater use, so the actual groundwater use from these permittees is unknown.

Table 3.22 Groundwater Withdrawal Permits for Farm Use

Aquifer	Permit ID	Permit Holder (Individual/Corporation)	GW Total Rate	
			(gpm)	(mgd)
Crystalline Rock	A00-069-0011	Jimmy A. Echols	80	0.12
Crystalline Rock	A02-069-0015	Aiken Real Estate LP	75	0.11
Crystalline Rock	A89-069-0003	Jimmy A. Echols	50	0.07
Crystalline Rock	A89-069-0004	Jimmy A. Echols	30	0.04
Crystalline Rock	A91-069-0009	Crystal Farms Inc.	75	0.11
Crystalline Rock	A91-069-0010	J. Marlin Smith	215	0.31
		Total	525	0.76

Source: Georgia EPD. Farm (Agricultural) Water Withdrawal Permits within the State of Georgia [Revised: 04 June 2013] http://www.gaepd.org/Documents/regcomm_wpb.html

3.3.5.4 Permits to Operate Drinking Water Systems

In addition to water withdrawal permits, the Georgia EPD also issues permits to operate public and private drinking water systems (Georgia Safe Drinking Water Act of 1977, O.C.G.A. 12-5-17, et seq.).

These permits track population served through groundwater systems, whereas withdrawal permits track quantity provided. **Table 3.23** provides a summary of current drinking water system permits in Hall County. According to the permit database, the total number of population served under these permits is approximately 7,500. Actual groundwater use for these permittees in 2012 was only about 0.53 mgd based on the monthly withdrawal records submitted by each permittee to the Georgia EPD.

Table 3.23 Drinking Water System Permit (as of May 2013)

WSID #[1]	Name[1]	Owner Type[1]	Population Served[1]	Reported 2012 Average Use (mgd)[2]
GA1390000	City of Flowery Branch	Municipality	2,532	0.277
GA1390002	City of Lula	Municipality	2,769	0.156
GA1390011	Lake Shore Forest Subdivision	Private	531	0.003
GA1390012	Leisure Lake Condo. Assoc. Inc.	Private	180	0.049
GA1390013	Lodge Haven Subdivision	Private	91	0.005
GA1390016	Surfside Club Estates	Private	485	0.020
GA1390039	Banks Mountain S/D	Private	96	0.004
GA1390100	Aqualand Marina Chatt. Park	Private	250	0.005
GA1390127	Mount Shores Condo Association	Private	302	0.007
GA1390130	Providence School	Private	60	0.004
GA1390132	Kangaroo Store #3342	Private	25	< 0.001[3]
GA1390133	North Georgia Canopy Tours	Private	250	< 0.001[4]
		Total Population Served	7,571	0.530

[1] Source: Georgia EPD. http://www.gaepd.org/Files_XLS/regcomm/wpb/PublicDrinkingWaterListPermitted2013.xls
[2] Reported Annual Average Use (mgd), obtained during a Georgia EPD file review of each permittee's monthly reporting records (October 2013).
[3] Groundwater use was reported as 0.166 million gallons per year.
[4] Groundwater use was reported as 0.108 million gallons per year.

3.4 Soils and Geology

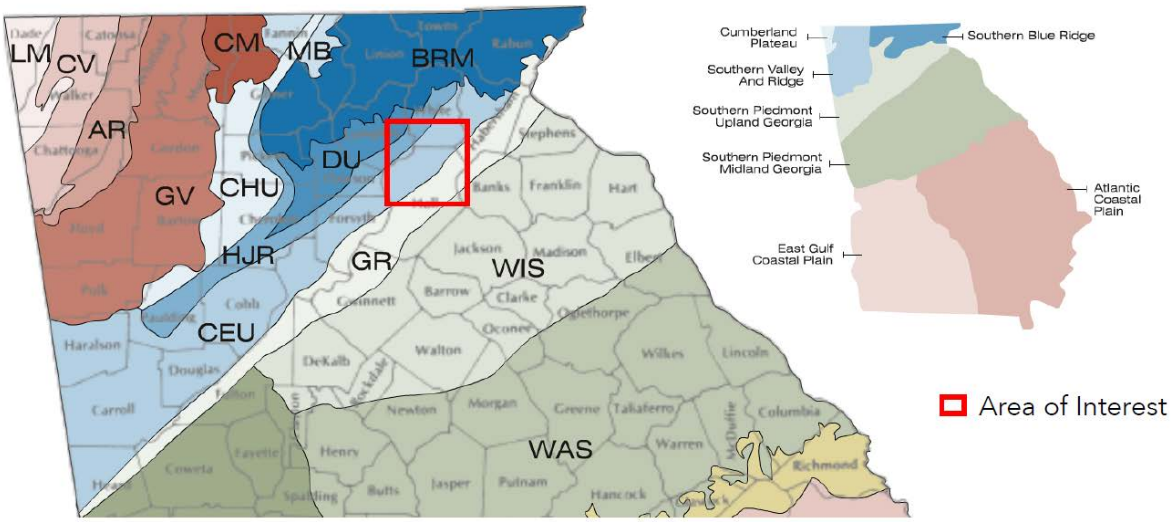
The soils and geology define the hydrology, topography, and ecology of a region, providing conditions that support natural habitats and landscape.

3.4.1 Physiography

Figure 3.23 shows the physiographic sections and districts of Georgia. The affected areas of the alternatives carried forward to be analyzed in detail are within the Gainesville Ridges and Central Uplands Districts of the Upland Georgia Subsection of the Southern Piedmont Section.

The affected areas are located within the Inner Piedmont geologic belt, which is characterized by moderate- to high-grade metamorphic rocks such as amphibolites, gneiss, schists, and igneous rocks such as granite (University of Georgia Department of Geology, undated).

Figure 3.23 Physiographic Districts of Georgia



Source: William Z. Clark, Jr. and Arnold C. Zisa, Physiographic Map of Georgia (DNR, 1976)

In northwest Georgia, the Gainesville Ridges District roughly follows the boundaries of the Brevard Fault zone and incorporates the City of Gainesville, as well as a large portion of Lake Lanier. The Glades Reservoir site and transmission systems lie within both the Central Uplands and Gainesville Ridges Districts. While the White Creek Reservoir site lies entirely within the Central Uplands District, its reservoir transmission system crosses into the Gainesville Ridges District.

This Gainesville Ridges District consists of a series of northeast-rending, low, linear, parallel ridges separated by narrow valleys. Highest elevations are up to 1700 ft MSL, with a total relief of 100 to 200 feet. Locations and orientation of these ridges strongly affect the path of the Chattahoochee River and its tributaries (Clark and Zisa, 1976).

The Central Uplands District borders the Gainesville Ridges District to the north and includes the northern third of Hall County and portions of White County. It is characterized by a series of low, linear ridges, at approximate elevations of 1300-1500 ft MSL, separated by broad, open valleys. The southern boundary of this district is the ridge crest that marks the beginning of the Gainesville Ridges District (Clark and Zisa, 1976).

3.4.2 Mineral Resources

Northeast Georgia is known for a variety of mineral resources, ranging from gold to marble. While gold was famously discovered in the City of Dahlonega, Georgia, in north adjacent Lumpkin County in 1828, gold was also found in Hall County around the same time. A large majority of the mines listed on the USGS Mineral Resources Data System in Hall and White counties are former gold mines (USGS, 2013a). The first gold mine in the area was reportedly operated in Gainesville, six years prior to the establishment of Dahlonega (McRay, 1990). Diamonds have also been reported in Hall County (McRay, 1990); a 1940 photograph provided by the Digital Library of Georgia purports to show “an old diamond mine in Hall County being inspected by Captain Garland Peyton, director of the State Division of Mines, Mining, and Geology" (Hall County Library System, 2008). Marble and granite are mined in other counties in northeast Georgia, but no active quarries for these commodities are currently identified by the USGS in Hall or White counties.

One former gold mine, Glade Mine, lies within the footprint of the proposed Glades Reservoir. No former mine sites were identified to be associated with the White Creek Reservoir site or on any transmission route. A review of the National Pipeline Mapping System (https://www.npms.phmsa.dot.gov/; accessed 4/23/15) identified a gas pipeline crossing the Chattahoochee River and I-985 perpendicularly just south of North Browning Bridge Road extending east toward SR 52. A second gas pipeline crosses west to east in the vicinity of the Lee Gilmer Airport and Candler Road. These pipelines may be located within the Reservoir Transmission System corridor.

3.4.3 Piedmont Hydrogeology

The reservoir sites and transmission system components of the alternatives carried forward for further evaluation are within the Piedmont geologic belt. The Piedmont geologic belt is underlain by a crystalline rock aquifer. The crystalline rock aquifer is overlain by a regolith of soils and saprolite of varying thicknesses, from 10 to 150 feet. The crystalline rocks have less than 2% primary porosity and little permeability. Most groundwater is stored in the saprolite, which has porosities of 20 to 30%. Water is transmitted from the saprolite to the crystalline bedrock via fractures that have formed in the rock. Typically, the fractures within the crystalline rocks contain very limited storage space for groundwater, so the Piedmont crystalline rock aquifers rely on the porosity of the weathered rock that overlie the crystalline rocks for water storage. Georgia's Regional Water Plans indicate that groundwater availability within the Piedmont crystalline rock aquifer is very limited (<10 mgd across the large belt).

3.4.4 Soils

The National Cooperative Soil Survey is a joint effort of the U. S. Department of Agriculture (USDA) and other federal, state (including the agricultural experiment stations), and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the federal part of the National Cooperative Soil Survey. Soil surveys contain information that affects land use planning in survey areas. Soil survey reports identify soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas.

Soil characteristics dictate how precipitation runs off the soil. For use in runoff calculations, soil types are classified into one of four hydrologic groups on the basis of hydraulic conductivity (**Table 3.24**). Hydraulic conductivity is defined as the infiltration ability of the least pervious soil layer in a soil profile.

Table 3.24 Hydraulic Conductivity and Hydrologic Soil Groups

Hydrologic Soil Group	Description	Hydraulic Conductivity (in/hr)	Runoff Potential When Thoroughly Wet
A	Sand, gravel, or loam: Less than 10% clay and more than 90% sand or gravel	Greater than 5.67	Low
B	Loamy-sand: 10 to 20% clay and 50 to 90% sand	1.42 to 5.67	Moderately Low
C	Loam plus sand, silt, or clay: 20 to 40% clay and less than 50% sand	0.14 to 1.42	Moderately High
D	Clayey or any soil with a water table within 2 feet of the surface: 40% clay and less than 50% sand	Less than 0.14	High
A/D, B/D, C/D	Mixed conductivity given the range of soil textures in the soil profile	D group soil, but drainable to the greater conductivity	High when undrained

Source: National Cooperative Soil Survey

Table 3.25 shows the breakdown of hydrologic soil groups potentially impacted at the reservoir sites and its water transmission systems**.**

Table 3.25 Hydrologic Soil Groups – Glades Reservoir and White Creek Reservoir

	Glades Reservoir			White Creek Reservoir		
Hydrologic Soil Group	River Water Transmission System	Reservoir	Reservoir Water Transmission System	River Water Transmission System	Reservoir	Reservoir Water Transmission System
A	6.3%	17.7%	0.6%	22.6%	2.0%	1.4%
B	93.7%	79.4%	95.1%	73.0%	24.4%	92.6%
C			0.3%		1.2%	0.2%
D					42.5%	1.8%
A/D		2.8%	3.8%		23.8%	3.8%
B/D					1.0%	
Water		0.1%				
Other			0.2%	4.3%		0.2%

Source: National Cooperative Soil Survey

3.4.5 Prime and Unique Farmlands

Georgia additionally recognizes two categories of important farmlands, based on their soil types: prime farmland and farmland of statewide importance. These areas are designated by soil group, based on the soil survey area. As designated by the USDA, prime farmland has the best combination of physical and chemical characteristics for producing beneficial crops and is available for this use. Prime farmland can be cropland, pastureland, range land, forestland, or other land, but not urban built-up land or water. In general, prime farmlands have an adequate and dependable water supply, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, few or no rocks, and soils that are permeable to water and air. Prime farmlands are not excessively erodible or saturated with water for a long period, and they either do not flood frequently or are protected from flooding. As part of the NRCS coordination efforts, form AD-1006 is under development. **Table 3.26** details the breakdown of recognized farmlands potentially impacted at the alternatives under consideration**.**

Table 3.26 Important Farmland – Glades Reservoir and White Creek Reservoir

Reservoir Site	Water Supply Infrastructure Components	Prime Farmland [1] (Acres)	Farmland of Statewide Importance [1] (Acres)
Glades Reservoir	Reservoir[2]	9.0	209.4
	River Water Transmission Systems[3,4]	1.8	1.8
	Reservoir Water Transmission Systems[4,5]	0.9	9.6
	New WTP at Glades[6]	0.0	0.0
White Creek Reservoir	Reservoir[2]	15.2	178.3
	River Water Transmission Systems[3,4]	0.0	0.0
	Reservoir Water Transmission Systems[4,5]	0.9	14.4

Notes:
[1] Based on publicly available county soils data and will be updated as appropriate based on ongoing coordination with NRCS.
[2] Based on farmland within the flood pool water surface area.
[3] Includes the intake/pump station at the river and the transmission main from the river to the reservoir.
[4] The disturbance area for the construction of the transmission main is based on a maximum easement width of 30 feet.
[5] Includes the intake/pump station at the reservoir, the transmission main from the reservoir to Lakeside WTP, and a booster pump station approximately midway for boosting water pressure.
[6] For selected alternatives only - area assessed for the new WTP at Glades includes areas for the raw water intake/pump station at the reservoir, the transmission main from the reservoir to the WTP, and the site for WTP.
Source: Soil Survey Staff, Natural Resources Conservation Service, USDA. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/.

In addition to agricultural potential of the Glades Reservoir footprint, the primary purpose of the approximately 8,000 acres of land in the vicinity of the proposed Glades Reservoir footprint is silvicultural use and is privately owned. The forests and wooded lots have been grown as a crop intended for future logging activities.

3.5 Land Use

Land use for the area affected by the Proposed Project and alternatives was obtained from the Georgia Land Use Trends (GLUT) Project. For this EIS, the most recently published data was the 2008 land use data for the State of Georgia, as was generated by LANDSAT. Within the GLUT database, land use is divided into the following categories:

- Beaches/Dunes/Mud – beaches, exposed sandbars, sand dunes, mud, dredge materials, and exposed lakeshore
- Open Water – all types of waterbodies: lakes, rivers, ponds, ocean, industrial water, and aquaculture, which contained water at the time of image acquisition
- Transportation – roads, railroads, airports, and runways
- Utility Swaths – vegetated linear features that are maintained for transmission lines and gas pipelines
- Low Intensity Urban – single-family residential areas, urban recreational areas, cemeteries, playing fields, campus-like institutions, parks, and schools
- High Intensity Urban – central business districts, multi-family dwellings, commercial facilities, industrial facilities, and high impervious surface areas of institutional facilities
- Clearcut/Sparse – areas that had been clearcut within the past 5 years, as well as areas of sparse vegetation
- Quarries/Strip Mines – mines and exposed rock and soil from industrial uses, gravel pits
- Rock Outcrop – geological features such as rock outcrops, and exposed mountaintops
- Deciduous Forest – forests that contain at least 75% deciduous trees in the canopy, deciduous mountain shrub/scrub areas, and deciduous woodlands
- Evergreen Forest – forests that contain at least 75% evergreen trees, pine plantations, and evergreen woodlands
- Mixed Forest – forests with mixed deciduous/coniferous canopies, natural vegetation within the fall line and coastal plain ecoregions, mixed shrub/scrub vegetation, and mixed woodlands
- Golf Course
- Pasture – pastures and non-tilled grasses
- Row Crop – row crops agriculture, orchards, vineyards, groves, and horticultural businesses
- Forested Wetland – all types of forested and shrub wetlands
- Coastal Marsh – coastal freshwater and brackish marsh
- Non-Forested Wetland – all freshwater emergent wetlands

Land use for each of the alternative sites is shown in **Table 3.27** and **Table 3.28**.

Table 3.27 Georgia Land Use Trends for Glades Reservoir Alternatives

Land Cover	River Water Transmission System		Glades Reservoir		Reservoir Water Transmission System (to Lakeside WTP)	
	Acres	Percentage of Area	Acres	Percentage of Area	Acres	Percentage of Area
Open Water	0.0	0%	0.0	0%	0	0%
Low Intensity Urban	4.0	25%	2	0%	72.7	70%
High Intensity Urban	0.0	0%	11.5	1%	16.9	16%
Clearcut/Sparse	2.9	11%	0.0	0%	4.0	4%
Quarries/Strip Mines/Rock Outcrop	0.0	0%	0.4	0%	0.0	0%
Deciduous Forest	2.7	10%	540.6	54%	5.34	5%
Evergreen Forest	2.2	7%	184.6	18%	3.56	3%
Mixed Forest	2.2	9%	113.0	13%	1.11	1%
Row Crop/Pasture	11.4	44%	128.5	13%	0.89	1%
Forested Wetland	0.0	0 %	19.6	2%	0.0	0%
Non-Forested Freshwater Wetland	0.0	0%	2.2	0%	0.0	0%

Table 3.28 Georgia Land Use Trends for White Creek Reservoir Alternatives

Land Cover	River Water Transmission System		White Creek Reservoir		Reservoir Water Transmission System (to Lakeside WTP)	
	Acres	Percentage of Area	Acres	Percentage of Area	Acres	Percentage of Area
Beach/Dune/Mud	0.0	0%	0.9	0%	0.0	0%
Low Intensity Urban	0.0	0%	16.2	3%	83.4	66%
High Intensity Urban	0.0	0%	0.4	0%	14.5	11%
Clearcut/Sparse	0.0	0%	30.25	5%	5.6	4%
Quarries/Strip Mines/Rock Outcrop	0.0	0%	0.0	0%	0.0	0%
Deciduous Forest	2.5	100%	348.1	54%	14.7	12%
Evergreen Forest	0.0	0%	50.7	8%	2.0	2%
Mixed Forest	0.0	0%	61.4	9%	0.4	0%
Row Crop/ Pasture	0.0	0%	77.2	12%	5.8	5%
Forested Wetland	0.0	0%	31.4	5%	0.0	0%
Non-Forested Freshwater Wetland	0.0	0%	0.0	0%	0.0	0%

3.6 Climate and Greenhouse Gas

3.6.1 Existing Climate

The climate of north Georgia, including all areas associated with the alternatives carried forward to be analyzed in detail, is classified as humid subtropical, and characterized by hot, humid summers and cool winters. Significant precipitation occurs in all seasons. Winter rainfall and occasional snowfall is associated with large storms tracking from west to east. Most summer rainfall occurs during thunderstorms and an occasional tropical storm or hurricane.

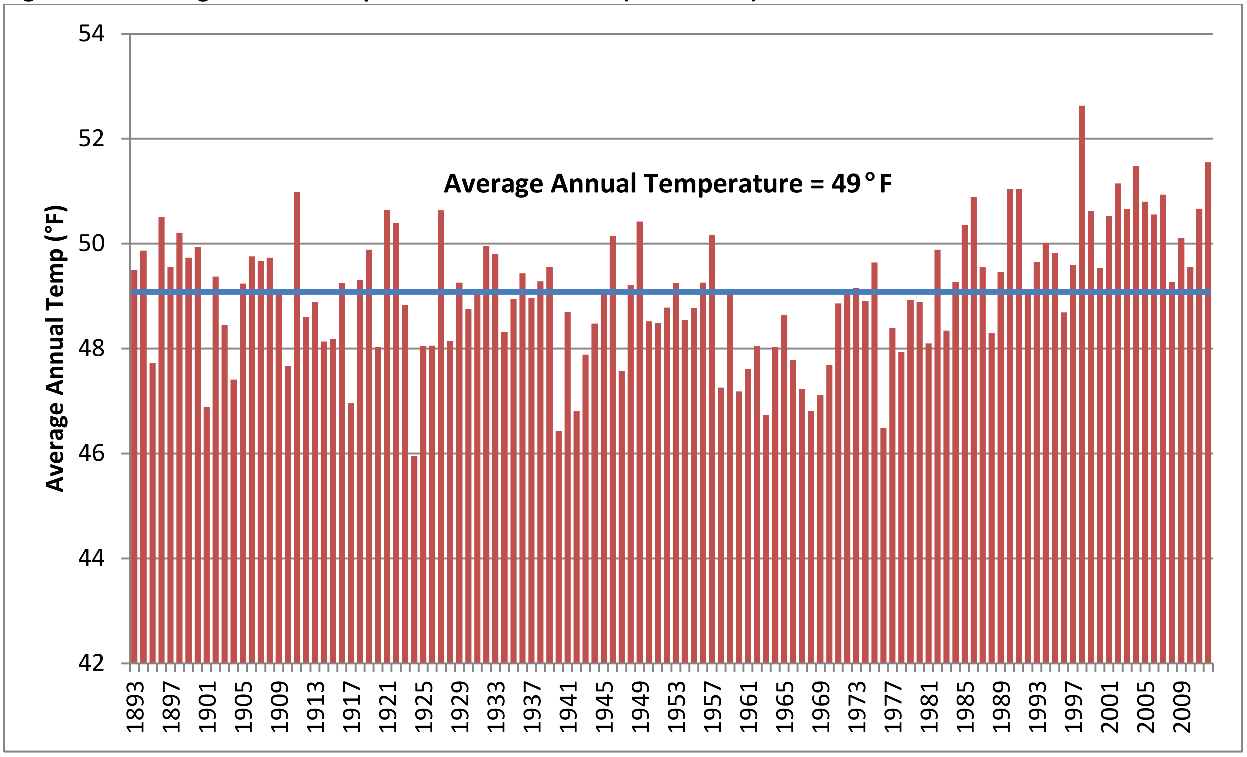
3.6.2 Temperature

Temperature in summer days in north Georgia may reach 90°F (32 degrees Celsius [°C]). Winter is characterized by mild temperatures and occasional snowfall, with colder, snowier weather and icing most likely across northern Georgia.

Based on temperature data at the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) site 093621 at Gainesville (GHCND: USC00093621) with more than 120 years of record (1892–2012), the average annual temperature for the affected area is approximately 49°F (9.5°C). **Figure 3.24** shows the annual average temperature for the period of 1892–2012. Daily temperature ranges from the low 30s to nearly 90°F. **Figure 3.25** shows the daily minimum, mean, and maximum temperatures by month at Gainesville (NCDC site 093621). The alternatives carried forward to be analyzed in detail are located approximately 9 miles of each other and within 20 miles of the Gainesville station; data from this station is considered representative for all alternatives.

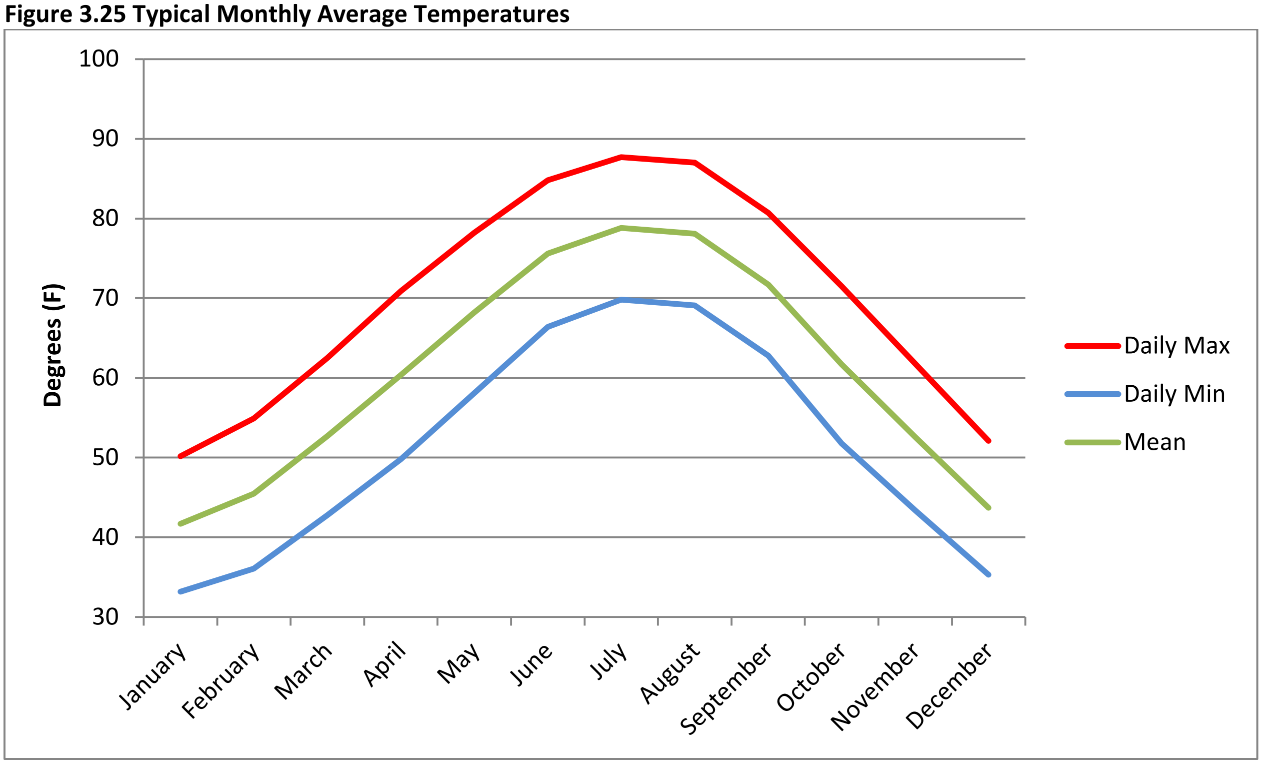
The multi-year summer average is estimated to be 74.5°F. **Figure 3.26** shows that average summer temperatures appear to be trending upward slightly since the 1970s when plotting against the multi-year summer average temperature.

Figure 3.24 Average Annual Temperature at Gainesville (1892–2012)



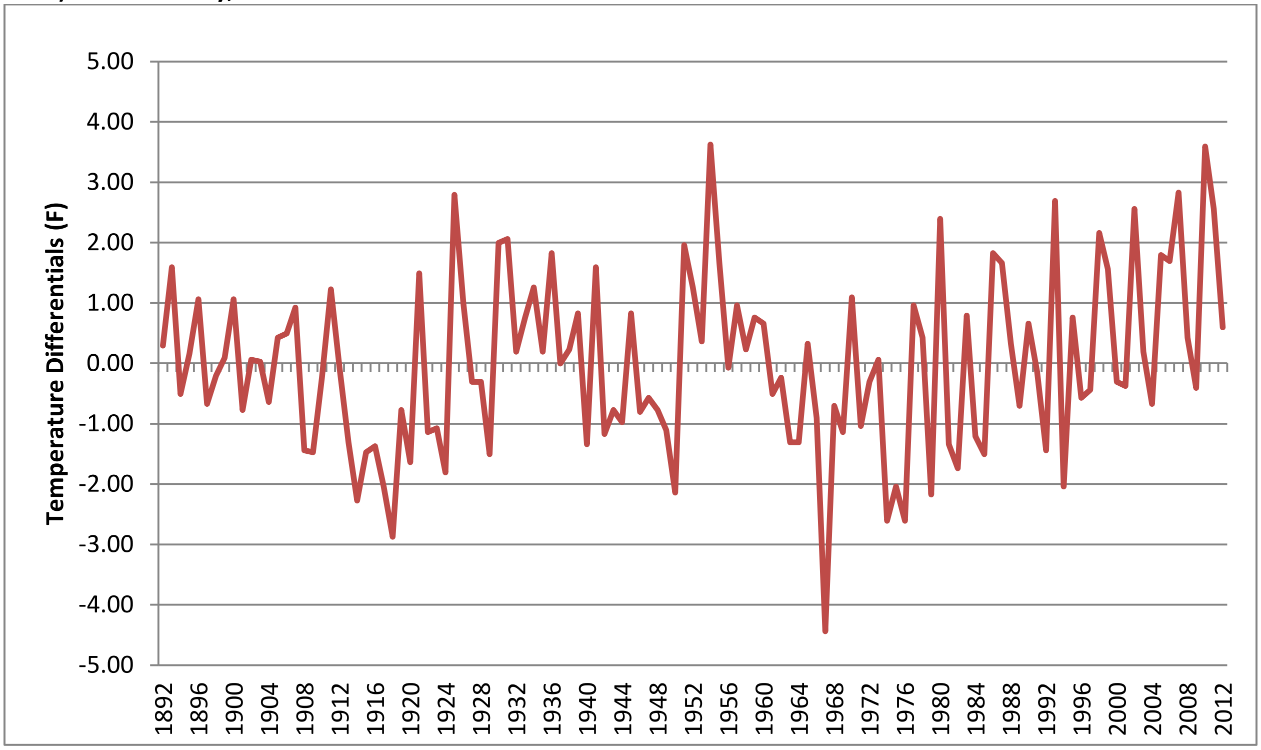
Source: NOAA National Climatic Data Center site 093621 at Gainesville

Figure 3.25 Typical Monthly Average Temperatures



Source: NOAA National Climatic Data Center site 093621 at Gainesville

Figure 3.26 Average Annual Summer Temperature Differential in Comparison to the Multi-Year Average (1892–2012) in Hall County, GA



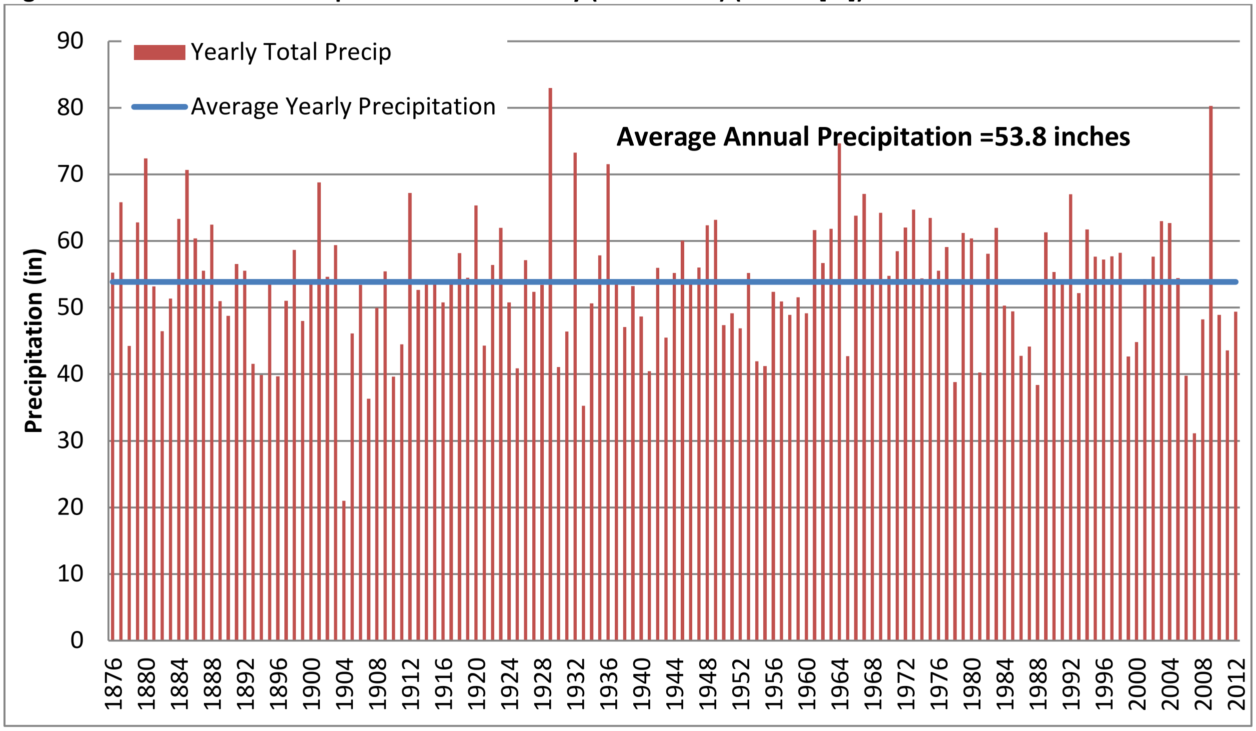
Source: NOAA National Climatic Data Center site 093621 at Gainesville

3.6.3 Historical Precipitation and Droughts

Due to the topographic lift of the Blue Ridge Mountains, the Upper Chattahoochee Basin is subject to intense local storms, as well as general storms of heavy rainfall over several days. The average annual total precipitation is 53.8 inches (**Figure 3.27**). The normal annual precipitation above Buford Dam is based on the NOAA NCDC site 093621 at Gainesville.

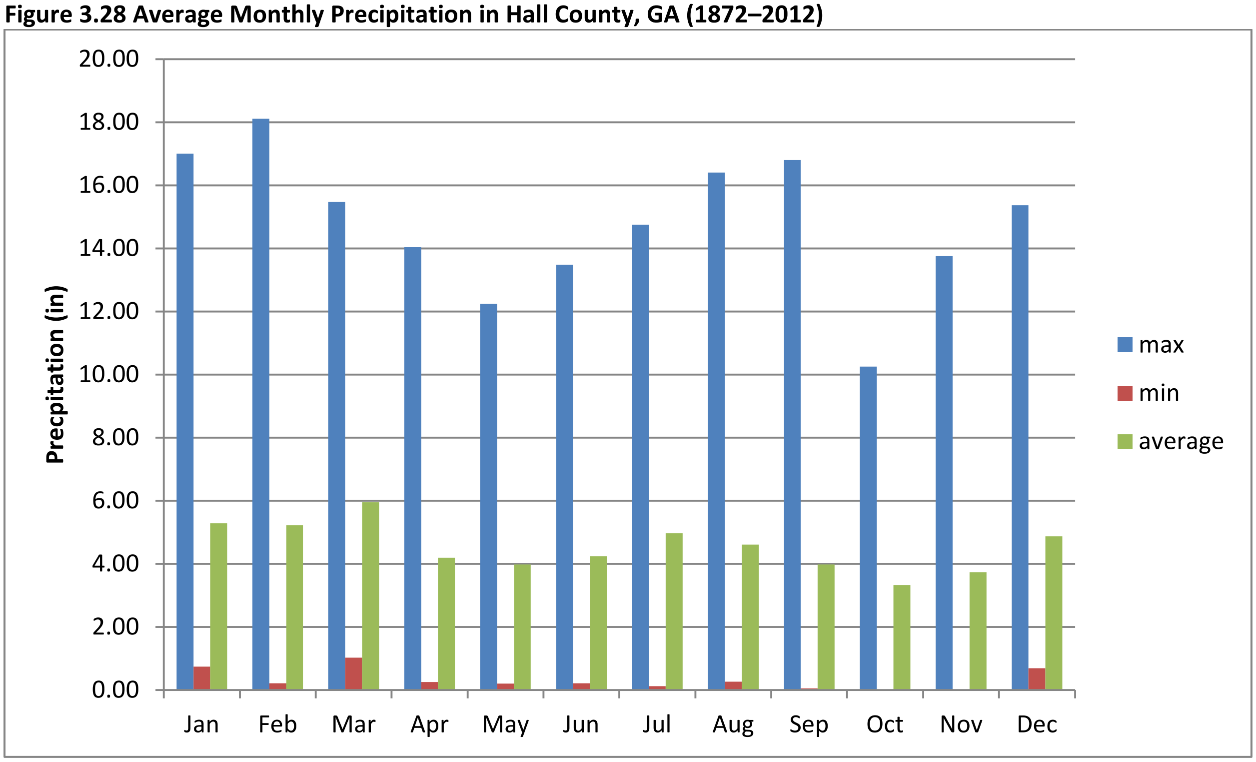
The general storms are more numerous and severe from late fall to early spring and have caused major floods in the basin. The maximum, minimum, and normal monthly precipitation at the Gainesville station is shown in **Figure 3.28**. About 39% of the normal annual precipitation occurs from December through March, while only about 20% occurs during the dry period September through November. The average annual snowfall is 3 to 4 inches, usually occurring in January and February.

Figure 3.27 Total Annual Precipitation in Hall County (1876–2012) (inches [in])



Source: NOAA National Climatic Data Center site 093621 at Gainesville

Figure 3.28 Average Monthly Precipitation in Hall County, GA (1872–2012)



Source: NOAA National Climatic Data Center site 093621 at Gainesville

Yearly rainfall amounts can be highly variable from year to year, as seen in **Figure 3.27**, ranging from 21 to 83 inches in a given year. The wet and dry periods produced by these variations in rainfall are cyclical in nature, and the differences in rainfall can be attributed to changes in climate and weather patterns. Periods of heavy rainfall can be caused by El Niño events, which bring heavy winter rain to the southeast, and active hurricane seasons, which can bring heavy rainfall in the late summer and fall. Droughts are loosely associated with La Niña events, but are more likely caused by atmosphere-ocean climate variability and by internal atmosphere variability.

With over 136 years of available rainfall data, the Chattahoochee River Basin has experienced numerous droughts, many of which have been considered severe. The years with the 10 lowest recorded annual precipitation are shown in **Table 3.29**.

Table 3.29 Lowest Recorded Annual Precipitation in Hall County, GA (1872–2012)

Year	Annual Precipitation (in)
1904	21.0
2007	31.1
1933	35.3
1907	36.3
1988	38.4
1978	38.8
1910	39.6
1896	39.7
2006	39.8
1894	39.9

Notes:
Historical Average = 53.8 inches
Source: NOAA National Climatic Data Center site 093621 at Gainesville

Several droughts occurring in the last few decades have resulted in low streamflows and low lake levels during the following drought periods throughout the region: 1980–1982, 1985–1989, 1998–2003, and 2007–2008. **Figure 3.29** and **Figure 3.30** show the Lake Lanier water surface levels during these drought periods. In 2007, the water level reached a low of 1,050.79 feet, recorded December 26, 2007. During the 2008 drought, the water level reached a low of 1,051.00 feet, recorded December 8, 2008 (**Figure 3.30**).

Figure 3.29 Lake Lanier Observed Pool Elevations (1980s)

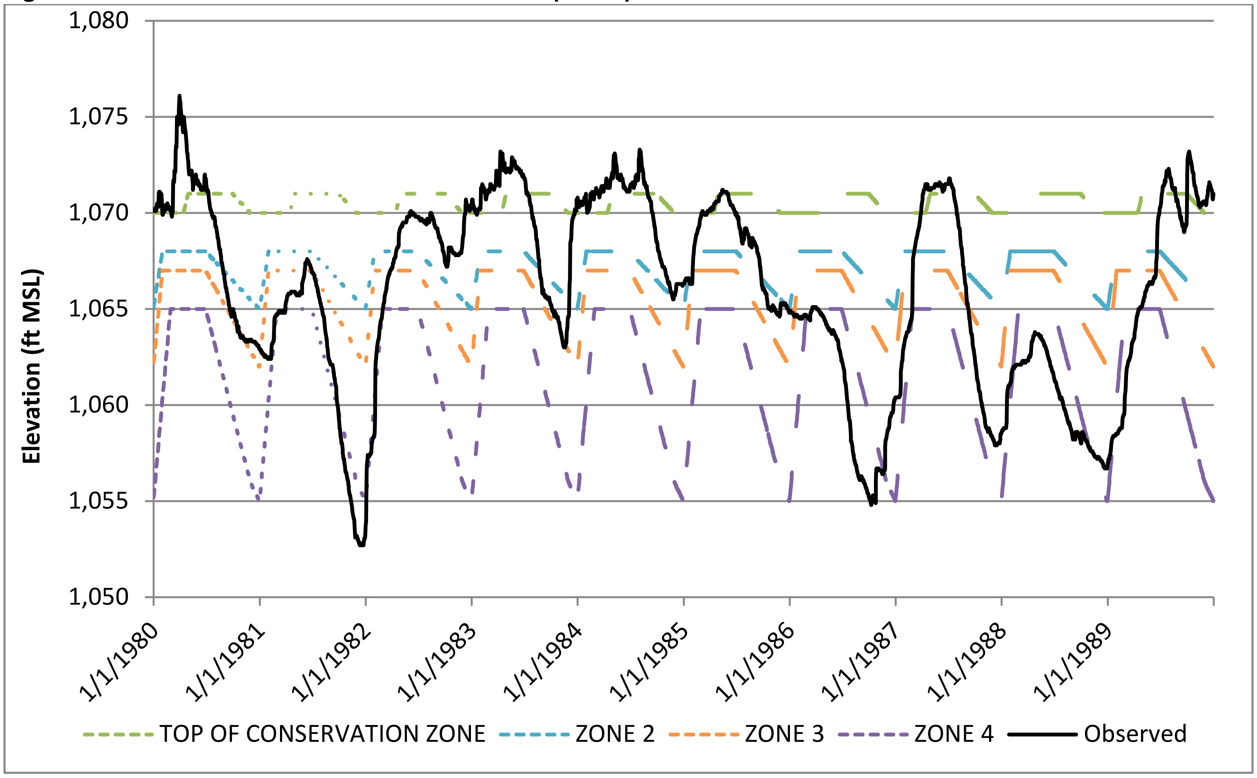
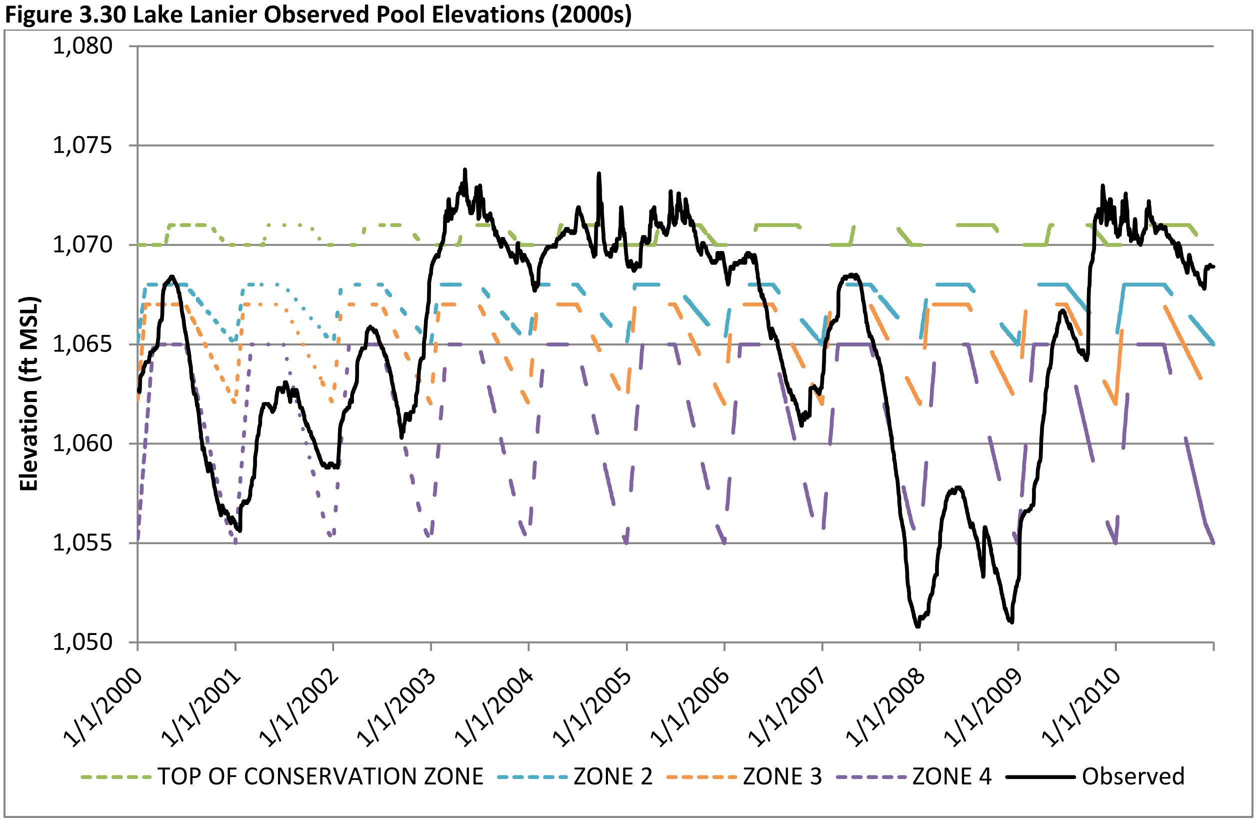


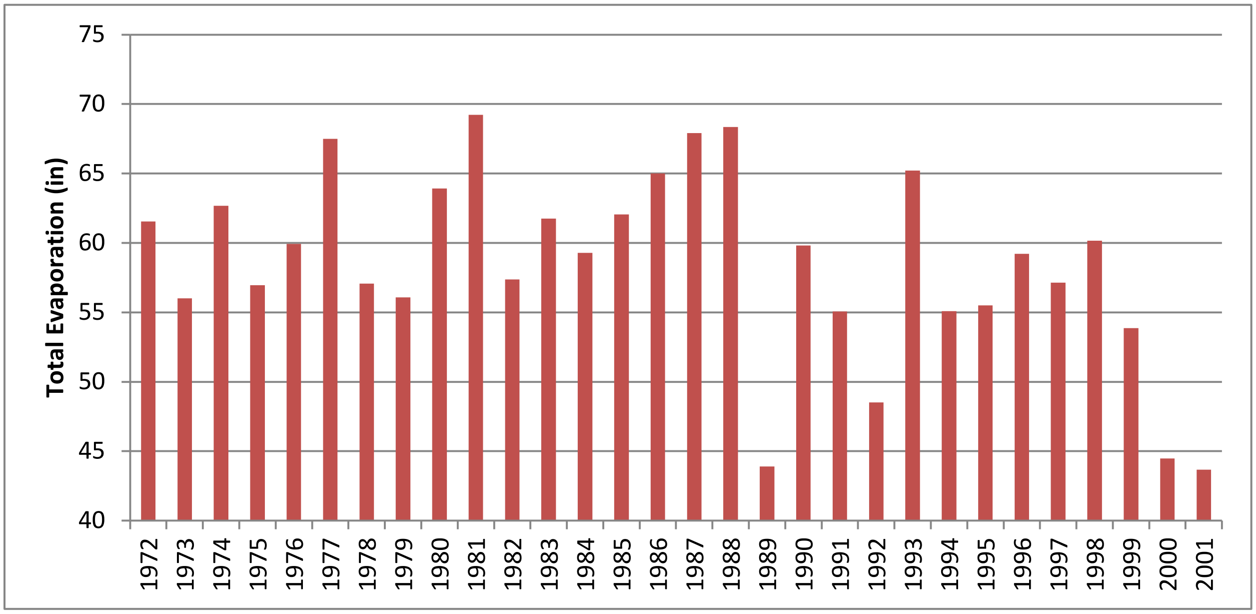
Figure 3.30 Lake Lanier Observed Pool Elevations (2000s)



3.6.4 Evaporation

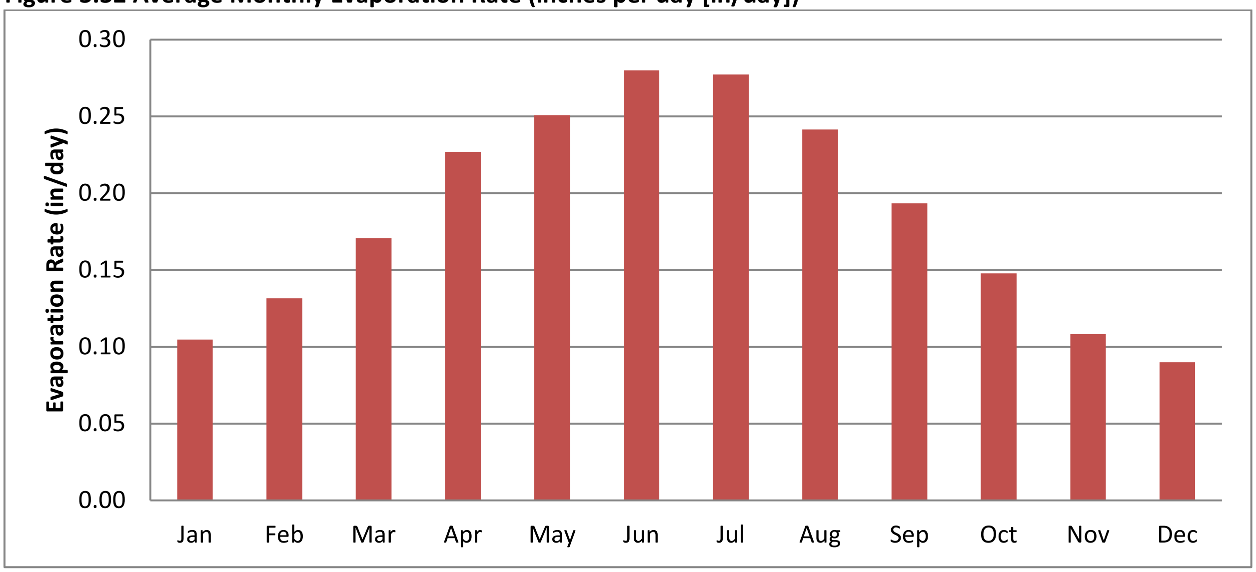
Regional evaporation data was obtained from the nearest available gage from the National Climatic Data Center at the University of Georgia (GHCND: USC00098950) in the adjacent Oconee County, Georgia. **Figure 3.31** shows that the total evaporation rate fluctuates between 44 inches and 69 inches annually with an average of 58.5 inches. **Figure 3.32** shows the average monthly evaporation rates for the period of record available. Evaporation is higher in the summer months (also months with lower streamflows) and lower in the winter months. This evaporation data is used to represent regional weather trends throughout the affected areas for the alternatives carried forward for further consideration.

Figure 3.31 Total Annual Evaporation (in) (1972–2001)



Source: National Climatic Data Center. University of Georgia Plant Science Farm, GA GHCND: USC00098950

Figure 3.32 Average Monthly Evaporation Rate (inches per day [in/day])



Source: National Climatic Data Center. University of Georgia Plant Science Farm, GA GHCND: USC00098950

3.6.4.1 Net Evaporation

For the purpose of determining future evaporation from the proposed reservoir sites, the Corps (Mobile District) provided net evaporation data, based on observed conditions at Lake Lanier (potential evaporation losses from each reservoir site will be discussed in Chapter 4). Net evaporation is defined as the difference between the evaporation and precipitation for any period of time. **Figure 3.33** shows the daily net evaporation variations, and **Figure 3.34** shows the average monthly net evaporation from Lake Lanier. When precipitation is greater than evaporation, net evaporation rates (as seen in wet months) are reported as negative values; when evaporation is greater than precipitation, positive net evaporation are reported (typical in dry months).

Figure 3.33 Daily Net Evaporation Rate at Lake Lanier (in) (1939–2012)

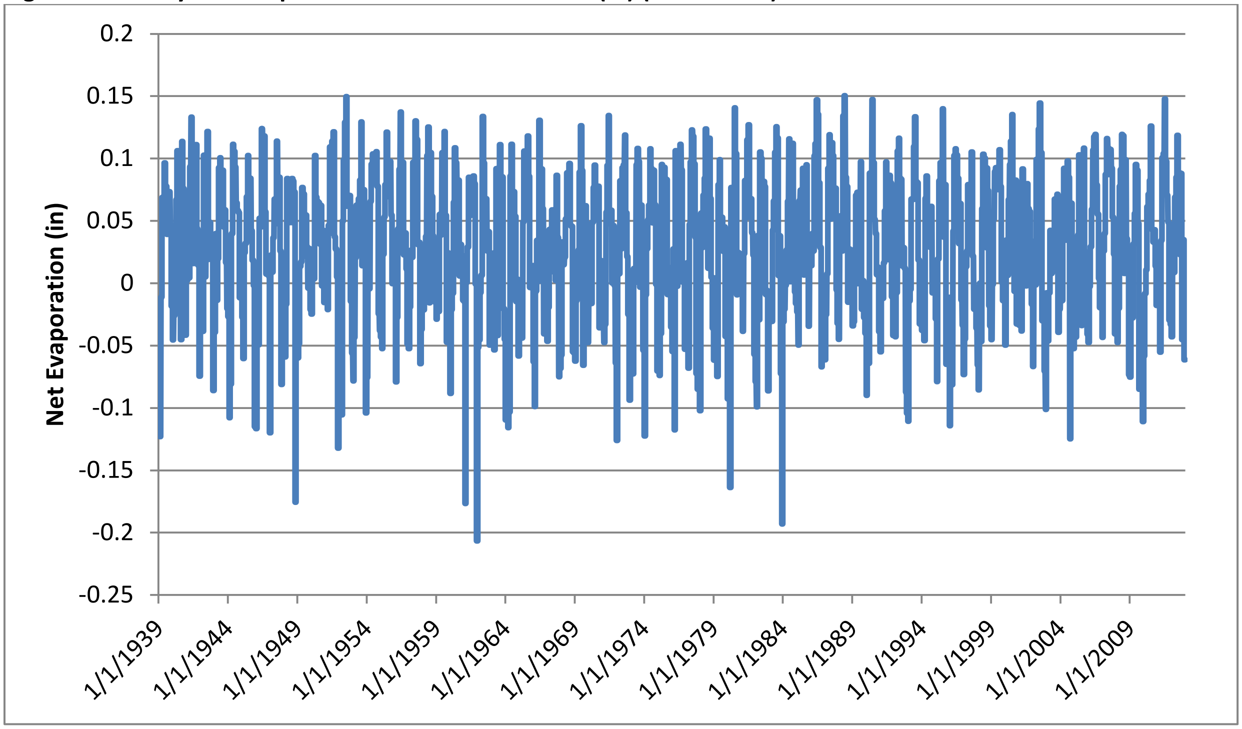
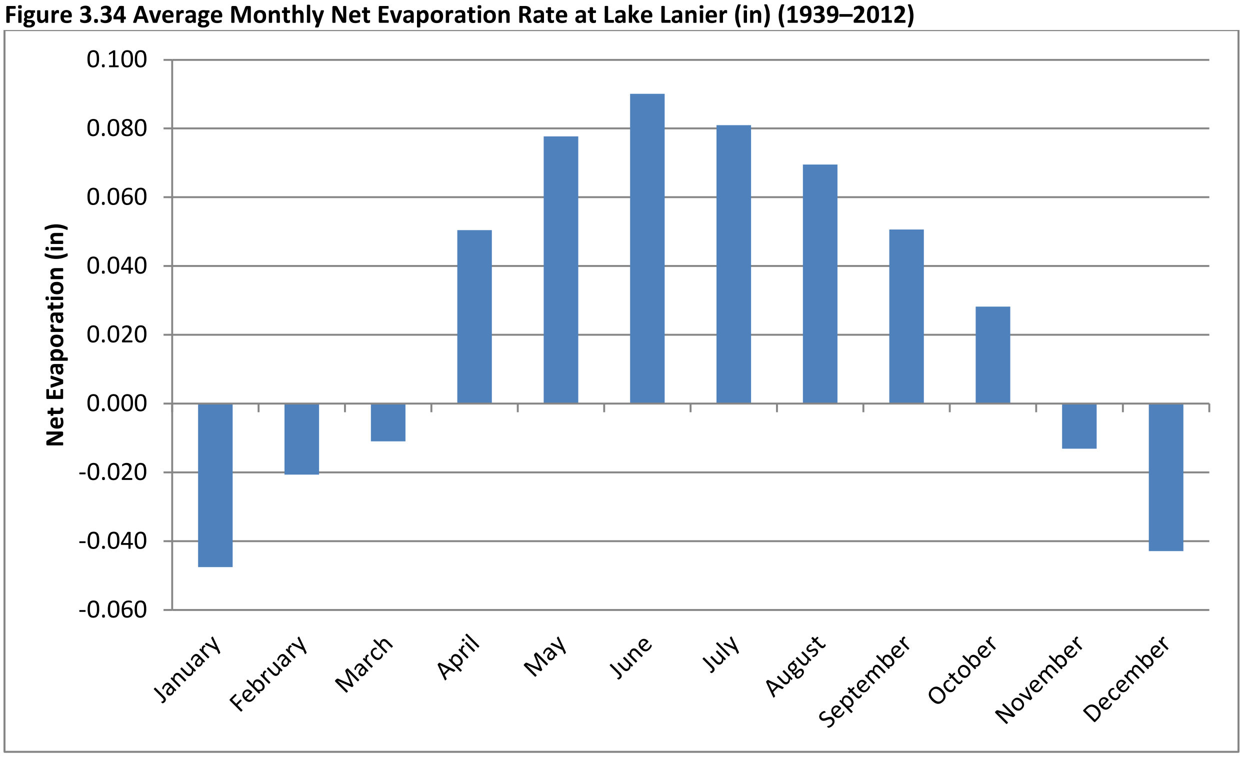


Figure 3.34 Average Monthly Net Evaporation Rate at Lake Lanier (in) (1939–2012)



3.7 Biological Resources

This section evaluates the existing conditions of biological resources in the rivers, tributaries, and wetlands for the alternative reservoir sites and associated transmissions systems located within Hall, White, and Habersham counties in Georgia. The reservoir site alternatives are located within the same region of Georgia and will have relatively similar natural biological resources. Specific resources discussed include vegetation resources, wildlife resources, fish and aquatic resources, and protected state and federal species. Any influences that may have created differences in the biological resources available for each of the alternatives carried forward for detailed analysis will be addressed in the following sections.

3.7.1 Upland Vegetation

The primary dominant vegetative types for the proposed reservoir alternatives were obtained from the GLUT Project. For this EIS, the most recently published data was the 2008 land use data for the State of Georgia, as was generated by LANDSAT. The following is a summary of the terrestrial vegetation communities in the affected areas. The reservoir sites and surrounding areas are rural, with extensive regrowth deciduous and evergreen forest of various ages. **Table 3.30** summarizes the vegetation types within the alternatives carried forward for further evaluation. The vegetation types were classified according to the dominant plant communities (such as grasses, shrubs, or trees), and dominance by native or introduced species.

Table 3.30 Vegetation Types in Alternatives Carried Forward for Further Evaluation

Dominant Tree Species	Common Understory Species
loblolly pine (Pinus taeda)	winged elm (Ulmus alata)
white pine (Pinus strobus)	sassafras (Sassafras albidum)
shortleaf pine (Pinus echinata)	dogwood (Cornus florida)
southern red oak (Quercus falcata)	red buckeye (Aesculus pavia)
red oak (Quercus rubra)	sugarberry (Celtis georgiana)
white oak (Quercus alba)	possum-haw (Ilex decidua)
mockernut hickory (Carya tomentosa)	witch hazel (Hamamelis virginiana)
sweetgum (Liquidambar styraciflua)	sparkleberry (Vaccinium arboreum)
post oak (Quercus stellata)	
water oak (Quercus nigra)	
shagbark hickory (Carya ovata)	
southern shagbark hickory (Carya caroliniana)	
basswood (Tilia americana)	

Source: A Comprehensive Wildlife Conservation Strategy for Georgia, Georgia DNR Wildlife Resources Division http://www1.gadnr.org/cwcs/Documents/strategy.html, August 31, 2005

3.7.1.1 Vegetative Regions and Ecoregions

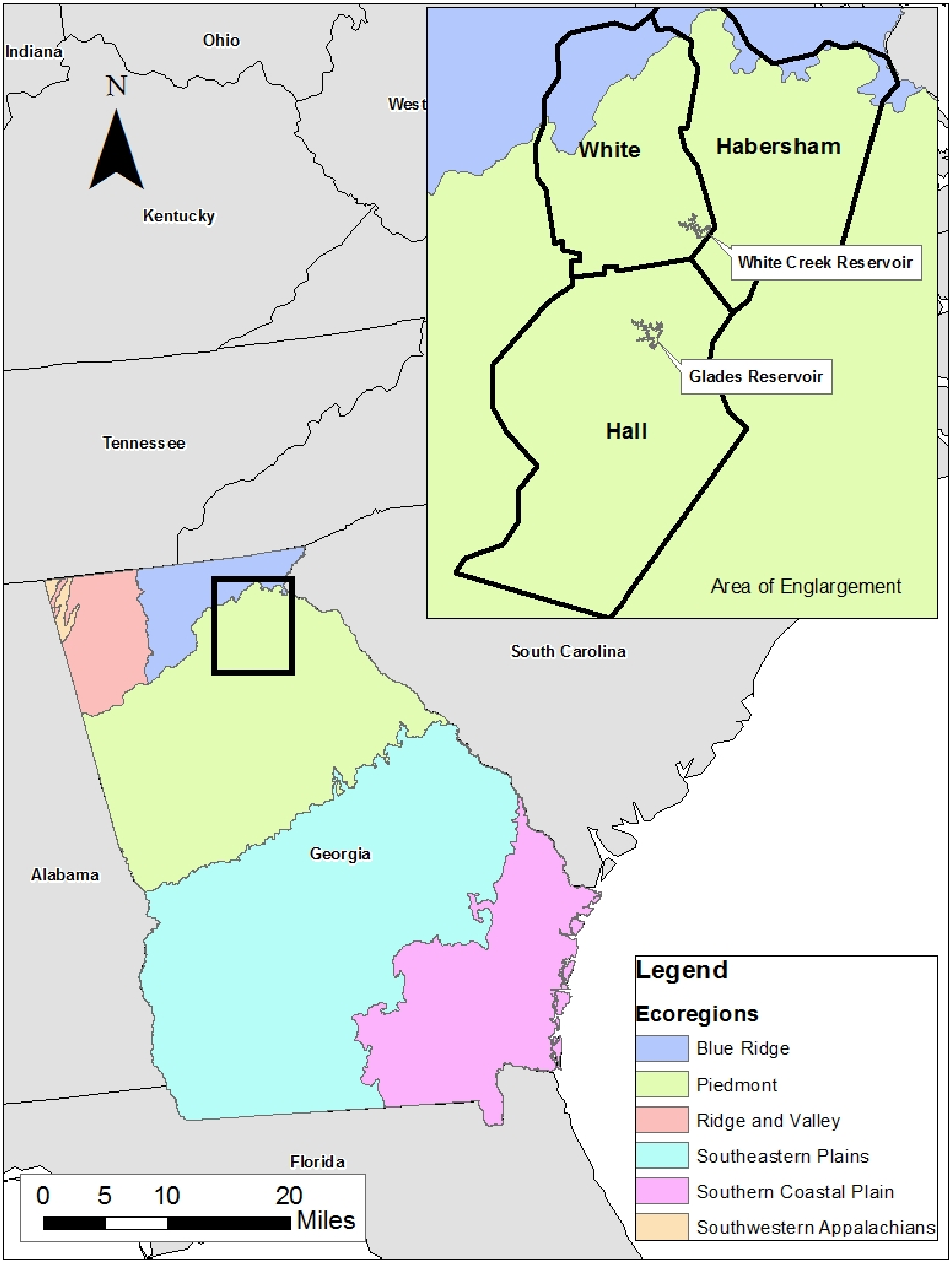
The ACF River Basin is made up of three physiographic provinces – the Blue Ridge, the Piedmont, and the Coastal Plain. The northernmost segment of the Chattahoochee River is within the Blue Ridge province, and is the location for the headwaters of the Chattahoochee River. The river flows southwestward into the Piedmont province, in which the distinction between the two provinces is defined by a sharp change in slope. The Chattahoochee River is within the Piedmont province from north of Lake Lanier to Columbus, Georgia. The Fall Line is the topographic boundary between the Piedmont province and Coastal Plain province. The river is marked by rapids and shoals at the Fall Line. From Columbus, Georgia, to the Gulf of Mexico, the Chattahoochee River is located within the Coastal Plain province.

The physiographic provinces coincide with three ecoregions (**Figure 3.35**) – the Blue Ridge, the Piedmont, and the Southeastern Plains. Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. The ecoregions are relatively different based on the distribution of terrestrial biota (Chattahoochee River Basin Plan, 1997; EPA Ecoregions, 2004). The Proposed Project and all alternatives carried forward for further evaluation, lie within the Piedmont ecoregion.

Piedmont Ecoregion

Considered the non-mountainous portion of the old Appalachian Highland, the northeast-southwest trending Piedmont ecoregion comprises a transitional area between the mostly mountainous ecoregions of the Appalachians to the northwest and the relatively flat coastal plain to the southeast. This region is comprised mainly of pine and hardwood woodlands. All of the alternatives carried forward to be analyzed in detail fall within the Southern Inner Piedmont subdivision of the Piedmont ecoregion. The Southern Inner Piedmont is mostly forested, with major forest types of oak-pine and oak-hickory, with less loblolly-shortleaf pine forest than the Southern Outer Piedmont. The field observations and review of recent aerial photographs support the general vegetation description of the Southern Inner Piedmont subdivision.

Figure 3.35 Georgia Ecoregions



Source: Georgia DNR, 2005

3.7.1.2 Vegetative Communities

Vegetative communities found in the Piedmont Ecoregion are discussed below, as organized by the categories used by the GLUT (Section 3.6) to allow straightforward comparison with the land use conditions. **Table 3.31** and **Table 3.32** summarize the vegetative communities for the reservoir alternatives.

Table 3.31 Vegetative Communities – Glades Reservoir Alternatives

	River Transmission System		Glades Reservoir		Reservoir Transmission System (to Lakeside WTP)	
Land Cover	Acres	Percentage of Area	Acres	Percentage of Area	Acres	Percentage of Area
Open Water, Low Intensity Urban, High Intensity Urban, Clearcut/Sparse, Quarries/ Strip Mines/ Rock Outcrop	5.8	25.0%	14.0	1.0%	99.0	89.0%
Deciduous Forest	1.1	11.0%	540.6	54.0%	5.6	16.0%
Evergreen Forest	1.3	7.0%	184.6	18.0%	3.6	3.0%
Mixed Forest	0.9	6.0%	113.0	11.0%	1.3	1.0%
Row Crop/ Pasture	6.9	43.0%	128.5	13.0%	1.3	1.0%
Forested Wetland	0.0	0.0%	19.7	2.0%	0.0	0.0%
Non-Forested Freshwater Wetland	0.0	0.0%	2.2	0.2%	0.0	0.0%

Note: The descriptions for the GLUT categories are derived from A Land Use and Land Cover Classification System for Use with Remote Sensor Data, USGS professional paper 964, Anderson et al., 1976, USGS.

Table 3.32 Vegetative Communities – White Creek Reservoir Alternatives

	River Transmission System		White Creek Reservoir		Reservoir Transmission System (to Lakeside WTP)	
Land Cover	Acres	Percentage of Area	Acres	Percentage of Area	Acres	Percentage of Area
Open Water, Low Intensity Urban, High Intensity Urban, Clearcut/Sparse, Quarries/ Strip Mines/ Rock Outcrop	0.0	0.0%	76.7	11.9%	103.4	82.0%
Deciduous Forest	2.5	100.0%	348.1	54.0%	14.7	12.0%
Evergreen Forest	0.0	0.0%	50.7	8.0%	2.0	2.0%
Mixed Forest	0.0	0.0%	61.4	9.0%	0.4	0.0%
Row Crop/ Pasture	0.0	0.0%	77.2	12.0%	5.8	5.0%
Forested Wetland	0.0	0.0%	31.4	5.0%	0.0	0.0%
Non-Forested Freshwater Wetland	0.0	0.0%	0.0	0.0%	0.0	0.0%

Note: The descriptions for the GLUT/vegetative communities categories are derived from A Land Use and Land Cover Classification System for Use with Remote Sensor Data, USGS professional paper 964, Anderson et al., 1976, USGS.

The categories of vegetative communities provided by the GLUT were originally detailed by Anderson (1976) in A Land Use and Land Cover Classification System for Use with Remote Sensor Data (USGS professional paper 964, Anderson et al., 1976, USGS), and the definitions of these categories are described below.

Open Water, Low Intensity Urban, High Intensity Urban, Clearcut/Sparse, Quarries/Strip Mines/Rock Outcrop

Vegetation within these areas is typically either disturbed, removed, or absent. Areas that have been able to re-establish vegetative cover or altered use, such as early successional growth on recent clearcuts or unused quarries that have become flooded, are placed in other more appropriate categories. **Figure 3.36** shows the vegetative communities based on 2008 land use cover for the areas surrounding the Glades Reservoir and White Creek Reservoir sites.

Deciduous Forest

Deciduous forest includes all forested areas having a predominance of trees that lose their leaves at the end of the frost-free season or at the beginning of a dry season. In most parts of the United States, these would be the hardwoods, such as oak (*Quercus*), maple (*Acer*), or hickory (*Carya*), and the "soft" hardwoods, such as aspen (*Populus tremuloides*).

Evergreen Forest

Evergreen forest includes all forested areas in which the trees predominantly remain green throughout the year. Both coniferous and broadleaved evergreens are included in this category. They include species such as shown in **Table 3.33**.

Table 3.33 Evergreen Forest Species

Eastern Species	
longleaf pine	*Pinus palustris*
slash pine	*Pinus ellioti*
shortleaf pine	*Pinus echinata*
loblolly pine	*Pinus taeda*
other southern yellow pines	*Pinus* spp.
various spruces	*Picea*
balsam fir	*Abies balsamea*
white pine	*Pinus strobus*
red pine	*Pinus resinosa*
jack pine	*Pinus banksiana*
hemlock	*Tsuga canadensis*

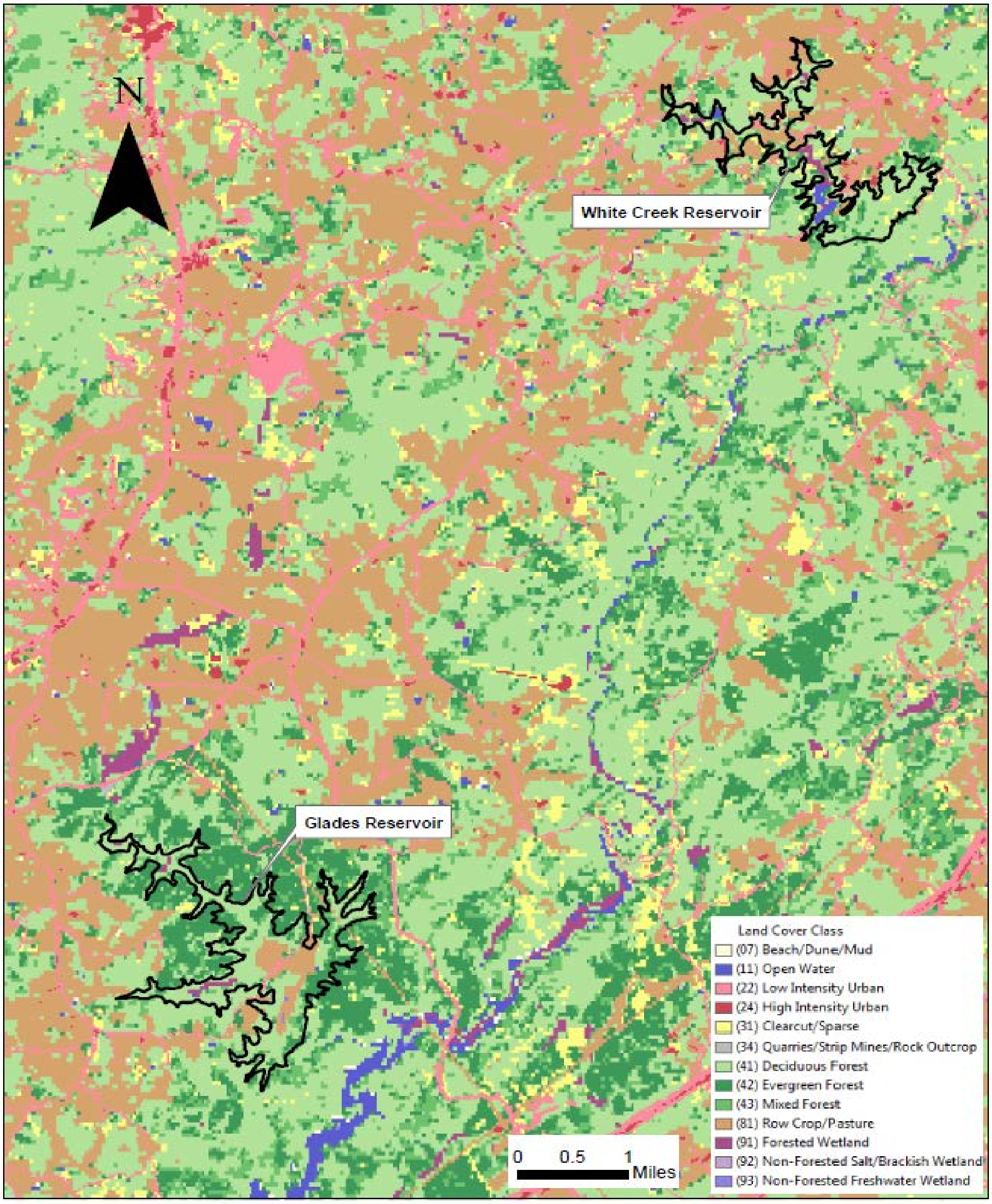
Western Species	
Douglas-fir	*Pseudotsuga menziesii*
Redwood	*Sequoia sempervirens*
ponderosa pine	*Pinus monticola*
Sitka spruce	*Picea sitchensis*
Engelmann spruce	*Picea engelmanni*
western redcedar	*Tsuga plicata*
western hemlock	*Tsuga heterophylia*

Source: Anderson, 1976

Mixed Forest

Mixed forestland includes forested areas where both evergreen and deciduous trees are growing and neither predominates. When more than one-third intermixture of either evergreen or deciduous species occurs in a specific area, it is classified as mixed forestland. Where the intermixed land use or uses total less than one-third of the specified area, the category appropriate to the dominant type of forestland is applied, whether deciduous or evergreen.

Figure 3.36 Vegetative Communities Based on Land Use Cover



Row Crop/Pasture

Cropland and pasture areas includes a variety of agricultural lands: cropland harvested, including bush fruits; cultivated summer fallow and idle cropland; land on which crop failure occurs; cropland in soil-improvement grasses and legumes; cropland used only for pasture in rotation with crops; and pasture on land more or less permanently used for that purpose. From imagery alone, it generally is not possible to make a distinction between cropland and pasture with a high degree of accuracy and uniformity, let alone a distinction among the various components of cropland. Moreover, some of the components listed represent the condition of the land at the end of the growing season and will not apply exactly to imagery taken at other times of the year.

Forested Wetland

Forested wetlands include wetlands dominated by woody vegetation. Forested wetlands include seasonally flooded bottomland hardwoods, mangrove swamps, shrub swamps, and wooded swamps, including those around bogs. Because forested wetlands can be detected and mapped by the use of seasonal (winter/summer) imagery, and because delineation of forested wetlands is needed for many environmental planning activities, they are separated from other categories of forestland.

Table 3.34 includes examples of typical vegetation found in forested wetlands.

Table 3.34 Vegetation – Forested Wetland Species

Wooded Swamps and Southern Floodplains	
cypress	*Taxodium*
tupelo	*Nyssa*
oaks	*Quercus*
red maple	*Acer rubrum*
Central and Northern Floodplains	
cottonwoods	*Populus*
ash	*Fraxinus*
alder	*Alnus*
willow	*Salix*

Floodplains of the Southwest	
mesquite	*Prosopis*
saltcedar	*Tamarix*
seepwillow	*Baccharis*
arrowweed	*Pluchea*
Northern Bogs	
tamarack or larch	*Larix*
black spruce	*Picea mariana*
heath shrubs	*Ericaceae*
Shrub Swamp	
alder, willow, and buttonbush	*Cephalanthus accidentalis*

Source: Anderson, 1976

Non-Forested Freshwater Wetland

Non-forested wetlands are dominated by wetland herbaceous vegetation or are non-vegetated. These wetlands include tidal and non-tidal fresh, brackish, salt marshes, and non-vegetated flats, and also freshwater meadows, wet prairies, and open bogs.

Table 3.35 includes examples of vegetation associated with non-forested wetland.

Table 3.35 Vegetation – Non-Forested Wetland Species

Narrow-Leaved Emergents	
Cordgrass	*Spartina*
Rush	*Juncus*
Cattail	*Typha*
Bulrush	*Scirpus*
Sedges	*Carex*
Sawgrass	*Cladium*
other grasses	Ex: *Panicum* and *Ziraniopsis miliacea*

Broad-Leaved Emergents	
waterlily	*Nuphar*, *Nymphea*
pickerelweed	*Pontederia*
arrow arum	*Peltandra*
arrowhead	*Sagittaria*
water hyacinth	*Eichhornia crassipes*
alligatorweed	*Alternanthera philoxeroides*
mosses	*Sphagnum*
sedges	*Carex*

Source: Anderson, 1976

3.7.2 Wetlands, Streams, and Other Waters

3.7.2.1 Waters of the United States

Waters of the United States (WOUS) refers to wetlands, tributaries, impoundments, and waters under the jurisdiction of the Corps as defined in 33 CFR 328.3. On May 27, 2015 the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (USACE) issued a new ruling on the Clean Water Act which, redefined criteria for evaluating WOUS. The current WOUS determinations are based on surveys conducted within previous guidance and guidelines. As the project continues, wetlands, tributaries, and impoundments identified in the field survey will be reviewed for applicability to the 2015 WOUS ruling and regulatory guidance..

The following data are used to identify the WOUS based on the geographic footprint of the alternatives to be carried forward for further evaluation:

- The Jurisdictional Waters Report (Kleinschmidt, 2011) and the Jurisdictional Determination SAS-2007-00388 by the Corps (June 7, 2012, **Appendix S** Agency Coordination) for the Glades Reservoir footprint and transmission system alternatives;
- National Wetlands Inventory (NWI), as prepared and maintained by the U.S. Fish & Wildlife Service (USFWS) and National Hydrography Dataset (NHD) depicts drainage networks with features such as rivers, streams, canals, lakes, ponds, and dams, as maintained by the USGS for the transmission pipeline from the Glades Reservoir alternative to the Lakeside WTP in Gainesville, Georgia, and also for all White Creek Reservoir footprint and pipeline alternatives.

Glades Reservoir and Water Transmission Systems

In May of 2011, an on-site delineation of wetland areas was conducted by the Applicant following the three-parameter method described in the Corps Wetlands Delineation Manual, the legally accepted system for identifying wetlands. All other WOUS, such as streams and lakes (waterbodies), were also field identified. Jurisdictional boundaries were located in the field and mapped by sub-meter Global Positioning System (GPS) equipment. This field-mapped information was used to calculate wetland/lake acreages and stream lengths within the footprints of the proposed Glades Reservoir and its water transmission systems.

The Applicant submitted the Jurisdictional Waters Report (Kleinschmidt, 2011), including data collected during the on-site delineation to the Corps on June 9, 2011, to assist the Corps in their jurisdictional determination of wetlands and waterbodies identified on the proposed reservoir site. **Figure 3.37** shows the WOUS identified on the Glades Reservoir site. After reviewing the request for jurisdictional determination, the Corps issued a regulatory project number of SAS-2007-00388 and field verified the location of jurisdictional wetlands and waterbodies on June 7, 2012 (see **Appendix S**, Agency Correspondence).

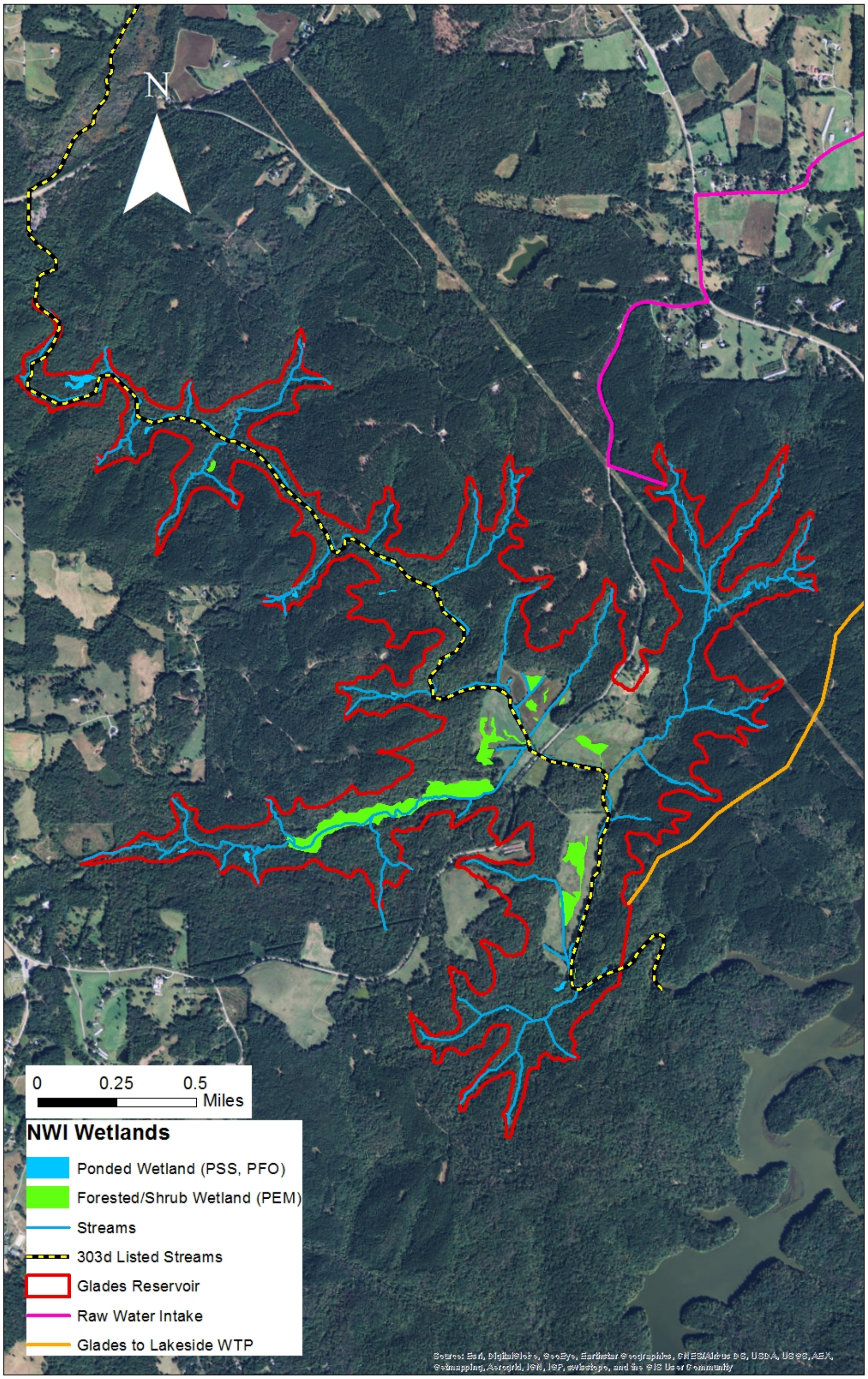
The results of the field survey and jurisdictional determination supersede the desktop analysis used for comparison in Chapter 2, Alternatives Analysis. The field surveyed quantity is approximately 4% higher for wetlands and 40% higher for streams, as compared to the estimates obtained based on desk-top analysis.

White Creek Reservoir and Water Transmission Systems

Although a field survey and on-site jurisdictional determination by Corps personnel is the ultimate determination of WOUS boundaries, the White Creek alternative reservoir site is privately owned and access for on-site field survey was difficult to obtain (more than 70 separately owned parcels) during this analysis. Therefore, a desktop analysis was completed for the White Creek alternatives using best available NHD and NWI datasets, along with a conversion factor based on the Glades field delineation.

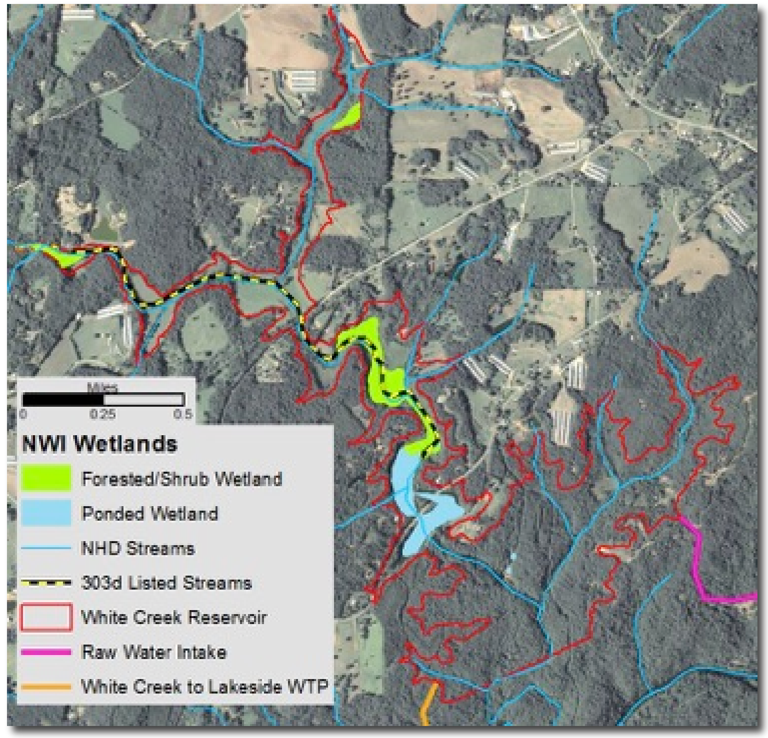
Figure 3.38 shows the NWI wetlands for the White Creek Reservoir site. The distribution and classification of WOUS in the NHD and NWI datasets are based on photointerpretation of recent aerial photographs and analysis of USGS topographical quadrangle maps.

Figure 3.37 NWI Wetlands at the Glades Reservoir Site



Given that the desktop analysis results for the Glades Reservoir site varied significantly from the field surveyed conditions noted in the Jurisdictional Waters Report (Kleinschmidt, 2011), an approach was developed to extrapolate potential field conditions from the available NHD/NWI data for the proposed White Creek Reservoir alternatives. Because of the sites' proximity to each other, it is assumed that both Glades Reservoir and White Creek Reservoir have a similar percentage of increase (approximately 4% higher for wetlands and 40% higher for streams) when converting the acreage or length from desktop analysis to field condition.

Figure 3.38 NWI Wetlands at the White Creek Reservoir Site



3.7.2.2 Criteria for Considering Quality of Wetlands, Streams, and Other Waters

The quality of WOUS was determined through multiple techniques, including:

- Photo interpretation of recent aerial photographs
- Analysis of the Jurisdictional Waters Report's mitigation calculation worksheets, and
- Evaluation of Georgia's Draft 2014 Integrated 305(b)/303(d) List of Impaired Waters.

Photo Interpretation of Recent Aerial Photographs

Aerial photo interpretation was used to discern indicators of reduced function. For wetlands, such indicators include clear-cut areas, pine plantations, farmed wetlands, and drainage ditches/canals. For streams, these indicators include trenching, culverting, piping, or impoundment. Based on aerial photo interpretation, wetlands were also classified into the most applicable Cowardin Classification by observing the vegetation present within the wetland areas identified in the NWI and NHD datasets. The USFWS utilize vegetative layers to assist with

Figure 3.39 Aerial Photograph of a wetland identified Wetland Identified within the Glades Reservoir Footprint (Bing Maps, 2014)

the classification of wetlands in its Classification of Wetlands and Deepwater Habitats of the United States. **Figure 3.39** shows an aerial photograph of a wetland identified within the proposed Glades Reservoir footprint.

Analysis of the Jurisdictional Waters Report's Mitigation Calculation Worksheets for the Glades Reservoir alternative, the Jurisdictional Waters Report (Kleinschmidt, 2011), and the Corps Savannah District Mitigation Standard Operating Procedure (SOP) worksheet were consulted to determine wetland quality. Wetland quality was reported as Existing Conditions on the SOP worksheet. Three classes out of five total classes (and the associated SOP impact factor weightings) were identified to describe existing wetland conditions:

- **Class 1** (2.0 impact factor) indicates a fully functional feature with no indication of recent disturbance. For example: mixed species hardwood forest with 40-year old or older dominant canopy trees, and no evidence of hydrologic alteration.
- **Class 2** (1.5 impact factor) indicates previous adverse impacts to aquatic function have occurred and these impacts can be described as minor and reversible, such that the system would be expected to fully recover without assistance. For example: mixed species hardwood forest with 20- to 40-year old dominant canopy trees, and no evidence of hydrologic alteration.
- **Class 3** (1.0 impact factor) indicates adverse impacts to aquatic function have occurred and without minor enhancement activities, the system would not fully recover. For example: mixed 10- to 20-year old hardwood stand with evidence of minor hydrological alteration such as few shallow ditches.
- **Class 4** (0.5 impact factor) indicates previous major adverse impacts to aquatic function have occurred and substantial enhancement would be necessary to regain lost aquatic functions, for example, clear-cut/cutover 0- to 10-year old stand dominated by early successional tree species (e.g., gums, maples, willows, etc.), and lacking many indigenous mast-producing hardwood species. In addition, these areas may have extensive hydrologic alteration (i.e., network of drainage ditches and canals).

Impact correction factors have been integrated into the evaluation of the quality of features to develop the mitigation requirements.

Evaluation of Georgia's Draft 2014 Integrated 305(b)/303(d) List of Impaired Waters

Georgia's Draft 2014 Integrated 305(b)/303(d) List of Impaired Waters was used to identify any impaired stream segments within the alternatives carried forward for further evaluation. Identified impairments are listed in the following sections as potential indicators of the quality of the water bodies. Two TMDL evaluations have been prepared for the Chattahoochee River Basin by the Georgia EPD.

The *Total Maximum Daily Load Evaluation for Twenty-Five Stream Segments in the Chattahoochee River Basin for Sediment* (Georgia EPD, 2008a) assessed the quality of stream segments within the Chattahoochee Basin with regard to impacts due to sediment. As measures of stream quality, it used two metrics: the Index of Biotic Integrity (IBI) and the modified Index of Well-Being (IWB). The categories and definition of IWB scoring criteria are described in the text box to the right. These IWB scoring criteria are used to assess the quality of waterbodies.

IWB Scoring Criteria

The modified IWB measures the health of the aquatic community based on the density and diversity or structural attributes of the fish community. IWB scoring criteria and integrity classes for wadeable streams in the Piedmont ecoregion of Georgia consists of five categories of quality ranging from 'very poor' to 'excellent.' An '**excellent**' rating is comparable to the best regional reference conditions containing all the regionally expected species for the habitat and stream size, including the most intolerant species; contains a full array of size classes with healthy fish species diversity in abundance; and retains a high total biomass. A '**good**' rating indicates a sample with species richness somewhat below expectation; species diversity falls; with a good number of individuals in the sample; and demonstrates some decreases in total biomass as trophic structure shows some signs of stress. A '**fair**' rating indicates species richness and diversity decline as some expected species are absent; the abundance of individuals declines; total biomass declines as some levels of the food web are low in abundance or missing; the trophic structure is skewed toward generalist feeders. A '**poor**' rating indicates a low number of individuals and very low species richness and diversity; there is an increase in the proportions of non-native species and hybrids; growth rates are depressed as samples are heavily skewed to the smaller size classes; and total biomass is low. A '**very poor**' rating is represented by few individuals, mainly generalist feeders with some sites dominated by non-native species; and contains a very low total biomass. The IBI assesses the biotic integrity of aquatic communities based on the functional and compositional attributes of the fish community.
(Source: Georgia DNR, 2005)

This TMDL *evaluation* determined that most of the sediment found in the streams in the Chattahoochee Basin is due to past land use practices and is referred to as "legacy" sediment. It concluded that if Best Management Practices (BMPs) are used to ensure that no net increase in sediment is delivered to the impaired stream segments, these streams will recover over time.

The *Total Maximum Daily Load Evaluation for Nine Stream Segments in the Chattahoochee River Basin for Fecal Coliform* (Georgia EPD, 2008b) assessed the quality of stream segments within the Chattahoochee Basin with regard to impacts from fecal coliform. The primary measure of impairment used was fecal coliform counts at sampling stations. A stream was placed on the partial support list if more than 10% of the samples exceed the fecal coliform criteria and on the not support list if more than 25% of the samples exceed the standard.

This TMDL evaluation did not explicitly conclude that the streams would recover over time, but it did recommend management practices that would be expected to achieve compliance with the criteria. These management practices include compliance with National Pollutant Discharge Elimination System (NPDES) permit limits and requirements, adoption of NRCS Conservation Practices, and application of BMPs appropriate to agricultural or urban land uses, where applicable.

Flat Creek is a 303(d) listed stream. According to the Draft Georgia 2014 305(b)/303(d) List of Impaired Waters, this portion of Flat Creek does not support its designated use as a fishing stream. The impairment is for biota impacted macroinvertebrate communities (BioM) as a result of urban runoff and additional unknown nonpoint source pollution. A TMDL Implementation Plan was finalized for BioM Flat Creek in 2008.

The Glades Reservoir river intake draws water from the Chattahoochee River and the transmission main (to the Lakeside WTP) crosses the Chattahoochee River. At these locations, the Chattahoochee River is listed as not supporting its designated use of recreation and drinking water due to fecal coliform contamination from non-point sources. In 2003, a TMDL was completed for trophic weighted residue value of mercury in fish tissue exceeding the Georgia EPD's human health standard. Additionally, a TMDL for fecal coliform was completed in 2008.

White Creek is also a 303(d) listed stream. According to the Draft Georgia 2014 305(b)/303(d), this stream is on a list of waters not supporting its designated use. In this case, White Creek does not meet its designated use as a fishing stream. The impairment is for biota impacted macroinvertebrate communities and also for biota impacted fish (BioF) communities as a result of unknown nonpoint source pollution. A TMDL Implementation Plan was finalized for BioM in 2003 and for BioF in 2008.

Similar to Glades Reservoir, the White Creek Reservoir river intake also draws water from the Chattahoochee River and the transmission main (to the Lakeside WTP) also crosses the Chattahoochee River. At these locations, the Chattahoochee River is listed as not supporting its designated use of recreation and drinking water due to fecal coliform contamination from non-point sources. In 2003, a TMDL was completed for trophic weighted residue value of mercury in fish tissue exceeding the Georgia EPD's human health standard. Additionally, a TMDL for fecal coliform was completed in 2008. Further south, the transmission main crosses Walnut Creek in Hall County. At this location, Walnut Creek is listed as not supporting its designated use of fishing due to BioM impairments from non-point source pollution.

3.7.2.3 Summary of Wetlands, Streams, and Other Waters

Glades Reservoir Alternatives

Glades Reservoir Site

Review of recent and historical aerial photographs (1993–2014) and Land Use mapping (Google Earth and Bing, 2014) of the Glades Reservoir site indicate that portions of this area have been used for agriculture and silvicultural since at least 1993. Flat Creek contains at least one weir, installed pre-1993, and the largest on-site wetland appears to be associated with beaver activity, which has resulted in the expansion of the stream to the edges of its floodplain.

Field investigations (Kleinschmidt, 2011) identified 43 separate wetland areas scattered throughout the Glades Reservoir footprint (**Table 3.36**). The majority of these (37) were toe-of-slope seeps measuring <0.5 acre, but larger wetlands also were present. The wetland types identified within the Glades Reservoir footprint are summarized in **Table 3.37**.

Table 3.36 Wetlands Types Identified within the Glades Reservoir Site

Wetland Type	Cowardin Classification	Quality/Existing Condition Class*	Area (acres)
Palustrine, Emergent, Frequently Flooded/Saturated Wetland	PEM1E	Class 4, Major Adverse Impacts	13.85
		Class 1, Fully Functional	0.35
Palustrine, Scrub-Shrub, Persistent, Seasonally Flooded/Saturated Wetland	PSS1E	Class 1, Fully Functional	0.10
Palustrine, Forested, Broad-Leaved Deciduous, Seasonally Flooded/Saturated Wetland	PFO1E	Class 1, Fully Functional	4.35
Palustrine Emergent/Scrub-Shrub Wetlands	PEM/PSS	Class 2, Minor Adverse Impacts	20.59
Total			39.24

Notes:
PEM1E – Palustrine, Emergent, Persistent, Seasonally Flooded/Saturated Wetland
PSS1E – Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Seasonally Flooded/Saturated Wetland
PFO1E – Palustrine, Forested, Broad-Leaved Deciduous, Seasonally Flooded/Saturated Wetland
PEM/PSS – Palustrine Emergent and Scrub-Shrub Wetland
*Class per Savannah District Wetland Mitigation SOP

According to the Jurisdictional Waters Report (Kleinschmidt, 2011, **Appendix S**), the Glades Reservoir site was found to contain many small spring seeps within the proposed normal pool area. These wetland areas were noted to be hydrologically driven by groundwater (e.g., spring-fed) saturation. Evidence of overbank flooding within standing water in depressions was also noted in these wetlands found along the main reach of Flat Creek.

The largest contiguous wetland observed was 20.59 acres of PEM/PSS wetland along a tributary of Flat Creek within the proposed reservoir pool. This area had a sparse overstory of sweetgum and sycamore. The dominant shrub layer species included black willow (*Salix nigra*) and hazel alder (*Alnus serrulata*). The herbaceous layer was dominated by soft rush, sedges, and arrowleaf (*Peltandra virginica*).

There were 56 jurisdictional waterbodies identified within the Glades Reservoir site (see **Table 3.37** below for summary of features). The majority of Flat Creek and its tributaries appeared to have not been significantly altered by human activity. However, previous and current agricultural activities in the lower reaches along the main stem of Flat Creek have resulted in channelization and disturbances in the riparian buffers along approximately 5,000 linear feet (LF) of the natural Flat Creek stream.

Table 3.37 Waterbodies Delineated within the Glades Reservoir Site and Transmission Main

Waterbody Type	Name	Hydrologic Unit Code (HUC)	Length (LF)
Glades Reservoir Site			
Perennial Streams	Flat Creek	03130001	22,732
Perennial Streams	Multiple Unnamed Streams	03130001	55,167
Intermittent Streams	Multiple Unnamed Streams	03130001	16,222
Total			94,121
Glades Reservoir Transmission Line			
Perennial Streams	Multiple Unnamed Streams	03130001	100

Source: Jurisdictional Waters Report, Kleinschmidt, 2011

The quality of the waterbodies located within the Glades Reservoir alternative are considered very poor as defined by the IWB and IBI scoring previously discussed and indicated by multiple sources, as is noted in **Table 3.38**.

Table 3.38 Waterbody Quality within the Glades Reservoir Site

Waterbody	Quality* IBI Score	IBI Category	IWB Score	IWB Category	Habitat Total	Notes
Flat Creek (Partially Supporting Designated Use)	20	Very Poor	4.90	Very Poor	63.2	9 miles from headwaters near Clermont to Lake Lanier
Flat Creek (Not Supporting Designated Use)	18	Very Poor	3.50	Very Poor	68.9	6 miles from headwaters, Gainesville to Lake Lanier
Flat Creek (per Kleinschmidt, 2011)	N/A	N/A	N/A	N/A	N/A	Previous and current agricultural activities in the lower reaches along the main stem of Flat Creek have resulted in channelization and perturbations in the riparian buffers along approximately 5,000 LF of channel.

Notes:
*Quality established for Hall County's §404 Permit Application (Corps Project #SAS-2007-00388) assumed all streams to be fully functioning.
Source: Georgia EPD, *Total Maximum Daily Load Evaluation for Twenty-Five Stream Segments in the Chattahoochee River Basin for Sediment*, 2008

River Water Transmission System

The raw water intake at the river is located approximately 3 river miles upstream of Belton Bridge Road on the west bank of the Chattahoochee River. The transmission line corridor connecting the intake pump station to Glades Reservoir generally runs southwest from the intake for approximately 4 miles to the reservoir. Field studies identified the presence of two (2) jurisdictional streams along the transmission main corridor (see **Table 3.39**). There were no wetlands identified along the alignment or at the intake location.

Reservoir Water Transmission System

For some of the alternatives carried forward to be analyzed in detail including Glades Reservoir, raw water from the reservoir will be released to Flat Creek and flow to Lake Lanier via the Chattahoochee River. For this conveyance strategy, approximately 168 LF of the streams will be impacted.

For other Glades alternatives, a transmission main is the proposed conveyance to transport raw water from the reservoir to either the Lakeside WTP or a new WTP near Glades Reservoir. The corridor connecting Glades Reservoir to the Lakeside WTP located east of Lake Lanier generally runs southwest from the proposed reservoir for approximately 25 miles. Geographic Information System (GIS) analysis of the NWI and NHD data for the Glades Reservoir Water Transmission System was used to identify the wetland areas that are summarized in **Table 3.39**.

Table 3.39 Wetland Types Identified along the Glades Reservoir Transmission Main Corridor

Wetland Type	Wetland Type	Area by Desktop Analysis[1] (acres)	Field Data[2] (acres)
Palustrine Emergent Wetland	PEM	0.52	0.54
Total		0.52	0.54

Notes:
[1 2] Field data from Jurisdictional Waters Report, Kleinschmidt, 2011, representing 4% increase from database.

GIS analysis of the NWI and NHD data for the Glades Reservoir Transmission System identified the waterbodies summarized in **Table 3.40.**

Table 3.40 Waterbodies Identified along the Glades Reservoir Transmission Main Corridor

Waterbody Type	HUC	Length by Desktop Analysis[1] (LF)	Area by Desktop Analysis[1] (acres)	Field Data[2]
Ponds	03070101	N/A	0.22	0.31 acres
Streams	03070101	1,875	N/A	2,625 LF
Total		1,875	0.22	0.31 acres Ponds/ 2,625 LF Streams

Notes:
[1] Desktop analysis based on NWI and NHD database.
[2] Field data from Jurisdictional Waters Report, Kleinschmidt, 2011, representing 40% increase from database.

White Creek Reservoir Alternatives

White Creek Reservoir Site

The White Creek Reservoir site is within southeastern White County west of the Chattahoochee River. Based on the methodology discussed in Section 3.7.2.1, it is estimated that the affected area has approximately 26.6 acres of wetlands, 21.7 acres of ponds (flooded wetlands), and 60,987 LF of streams. These wetlands and waterbodies are summarized in **Table 3.41** through **Table 3.43**. Review of aerial photographs and Land Use mapping of the White Creek Reservoir site indicate that this area is predominately forested in nature (71%).

Water Transmission System

The raw water intake pump station for White Creek Reservoir is located approximately 2 river miles downstream of Duncan Bridge Road on the west bank of the Chattahoochee River. The corridor connecting the intake pump station to White Creek Reservoir runs southwest from the intake pump station for approximately 0.35 miles to the reservoir. There are no wetlands and/or waterbodies identified within the corridor of the transmission main and the intake pump station location.

Reservoir Water Transmission System

For one White Creek alternative, raw water from the reservoir will be released to White Creek and flow to Lake Lanier via the Chattahoochee River. It is estimated that approximately 1.5 miles of the creek and river will be affected.

For the other White Creek alternatives, a transmission main will transport water from the proposed reservoir to the existing Lakeside WTP. The transmission main will originate near the southern limits of the proposed dam location. The corridor connecting White Creek Reservoir to Lakeside WTP located east of Lake Lanier generally runs southwest from the reservoir for approximately 31 miles. The wetland areas identified for the White Creek Reservoir alternatives are summarized in **Table 3.41**. The waterbodies identified for the White Creek Reservoir alternatives are summarized in **Table 3.42**.

Table 3.41 Wetlands Associated with White Creek Reservoir Alternatives

Wetland Type	Cowardin Code	Area by Desktop Analysis (acres)	Area Including Field Correction Factor (acres) (Quantitative Increase of 4%)
Wetlands Identified within the White Creek Reservoir Footprint			
Palustrine Forested/Scrub-Shrub Wetland	PFO/PSS	24.8	25.8
Palustrine Unconsolidated Bottom (Flooded/Ponded)	PUB	20.9	21.7
Sub-Total		45.7	47.6
Wetlands Identified within the White Creek Reservoir Transmission Main Corridor			
Palustrine Emergent Wetland	PEM	0.7	0.7
Sub-Total		0.7	0.7
Total Wetlands for the White Creek Reservoir Site		46.5	48.3

Table 3.42 Waterbodies Associated with White Creek Alternatives

Waterbody Type	HUC	Length by Desktop Analysis (LF)	Length Including Field Correction Factor (LF) (Quantitative Increase of 40%)
Waterbodies Identified within the White Creek Reservoir Footprint			
Streams	03130001	41,312	57,837 LF
Waterbodies Identified Along the White Creek Reservoir Transmission Main Corridor			
Streams	03130001	2,250	3,150 LF
Total Waterbodies for the White Creek Reservoir Site		43,562	60,987 LF

The quality of the waterbodies located within the White Creek Reservoir affected area is considered very poor to poor as indicated by multiple sources, as shown in **Table 3.43**.

Table 3.43 Waterbody Quality Associated with White Creek Alternatives Carried Forward to be Analyzed in Detail

Waterbody	Quality					Notes
	IBI Score	IBI Category	IWB Score	IWB Category	Habitat Total	
White Creek (Partially Supporting)	20	Very Poor	5.30	Poor	60.8	6 miles from Headwaters to Webster Lake, Cleveland

Source: Georgia EPD 2008a.

3.7.3 Wildlife

This section focuses on the wildlife resources identified in the affected areas located within the Upper Chattahoochee River Basin of the Piedmont ecoregion of Georgia. Specifically, those species known or likely to occur in riparian or terrestrial areas are identified as species potentially impacted by the Proposed Project and alternatives. Divisions have been made between the terrestrial and aquatic species below and among ecosystems or ecosystem types from terrestrial and riparian to aquatic. The wildlife species descriptions in this section are applicable to all alternatives carried forward to be analyzed in detail, including reservoir sites and their associated transmission systems.

The affected area lies entirely within the Piedmont ecoregion. Several habitat types are common among the alternatives, including deciduous forests, evergreen forests, forested wetlands, high and low intensity urban areas, mixed forest, non-forested freshwater wetlands, open waters, and agricultural lands.

3.7.3.1 Terrestrial Species

Mammals

The mammals in the Piedmont tend to be generalist species in terms of the habitats they occupy. Most mammals occurring in the Piedmont can also be found in other regions of the state. Although most of the Piedmont is upland, scattered wetland habitats like river bottoms and beaver swamps provide habitat for several wetland mammals such as the swamp rabbit (Sylvilagus aquaticus), beaver (Castor canadensis), mink (Neovison vison), muskrat (Ondatra zibethicus), and river otter (Lontra canadensis). The fall line represents the northern extent of ancient seas and separates the Coastal Plain from the Piedmont. At the fall line, the land changes rapidly from the clay soils of the Piedmont to the deep sands of the Coastal Plain. Although many of the same mammals occur in both regions, some mammals are adapted to conditions in only one region or the other (Castleberry, 2015). Additional mammal species that may be found in the vicinity of each of the potential alternatives are included in **Table 3.44**.

Table 3.44 Mammal Species in Piedmont Ecoregion

Mammal Species	
Common Name	Scientific Name
Virginia opossum	*Didelphis virginiana*
southern short-tailed shrew	*Blarina carolinensis*
eastern pipestrelle	*Pipistrellus subflavus*
Mexican free-tailed bat	*Tadarida brasiliensis*
eastern cottontail	*Sylvilagus floridanus*
eastern gray squirrel	*Sciurus carolinensis*
eastern fox squirrel	*Sciurus niger*
eastern chipmunk	*Tamias striatus*
American beaver	*Castor canadensis*
round-tailed muskrat	*Neofiber alleni*
striped skunk	*Mephitis mephitis*
flying squirrel	*Glaucomys volans*
Mammal Species (continued)	
Common Name	Scientific Name
red fox	*Vulpes vulpes*
gray fox	*Urocyon cinereoargenteus*
river otter	*Lutra canadensis*
deer mouse	*Peromyscus maniculatus*
hispid cotton rat	*Sigmodon hispidus*
eastern woodrat	*Peromyscus gossypinus*
coyote	*Canis latrans*
northern raccoon	*Procyon lotor*
bobcat	*Lynx rufus*
feral pig	*Sus scrofa*
white-tailed deer	*Odocoileus virginianus*

Source: Mammals, New Georgia Encyclopedia, 2013

Birds

Potentially affected areas support an abundant and diverse avifauna, including many year-round residents, summer residents/migratory birds, and winter residents/migratory birds. The rolling hills of the Piedmont region once supported large agricultural fields but now are scattered with pine and hardwood forests of many ages. About 110 to 115 species of birds nest in the region. The Piedmont is also an area with an increasing number of nesting birds that have been invading the area, mainly from the north, during the last 50 years (Meyers, 2015). Some examples of commonly occurring bird species that occur year-round or seasonally are included in **Table 3.45**.

Table 3.45 Bird Species in Piedmont Ecoregion

Year-Round Bird Species	
Common Name	Scientific Name
wood duck	*Aix sponsa*
great blue heron	*Ardea herodias*
great egret	*Ardea alba*
red-shouldered hawk	*Buteo lineatus*
eastern screech-owl	*Megascops asio*
barred owl	*Strix varia*
red-bellied woodpecker	*Melanerpes carolinus*
pileated woodpecker	*Dryocopus pileatus*
blue jay	*Cyannocitta cristata*
northern mockingbird	*Mimus polyglottos*
northern cardinal	*Cardinalis cardinalis*
American crow	*Corvus brachyrynchos*
ring-necked duck	*Aythya collaris*
black vulture	*Coragyps atratus*
turkey vulture	*Cathartes aura*
red-tailed hawk	*Buteo jamaicensis*
great horned owl	*Bubo vigninianus*
Chuck-will's-widow	*Caprimulgus carolinensis*

Year-Round Bird Species (Continued)	
Common Name	Scientific Name
Carolina chickadee	*Poecile carolinensis*
tufted titmouse	*Baeolophus bicolor*
brown-headed nuthatch	*Sitta pusilla*
eastern towhee	*Pipilo erythrophthalmus*
Carolina wren	*Thryothorus ludovicianus*
Winter Bird Species	
mallard	*Anas platyrhynchos*
hooded merganser	*Lophodytes cucullatus*
sharp-shinned hawk	*Accipiter striatus*
ruby-crowned kinglet	*Regulus calendula*
yellow-rumped warbler	*Dendroica coronate*
swamp sparrow	*Melospiza georgiana*
Summer Bird Species	
little blue heron	*Egretta caerulea*
cattle egret	*Bubulcus ibis*
ruby-throated hummingbird	*Archilochus colubris*
eastern kingbird	*Tyrannus tyrannus*

Source: Birds, New Georgia Encyclopedia, May 2015

Amphibians and Reptiles

No habitats that are especially important to amphibians and reptiles are unique to the Piedmont ecoregion, since this ecoregion contains a range of species that also occur statewide. The areas surrounding the reservoir alternatives contain commonly found habitats for a diverse assemblage of reptiles and amphibians (**Table 3.46**).

Table 3.46 Reptile Species in Piedmont Ecoregion

Snake Species	
Common Name	Scientific Name
eastern hognose	*Heterodon platirhinos*
copperhead	*Agkistrodon contortix*
eastern garter snake	*Thamnophis sirtalis sirtalis*
brown water snake	*Nerodia taxispilota*
corn snake	*Elaphe guttata guttata*
timber rattlesnake	*Crotalus horridus*
rat snake	*Elaphe obsoleta*

Other Reptile Species	
Common Name	Scientific Name
tiger salamander	*Ambystoma tigrinum*
spotted salamander	*Ambystoma maculatum*
squirrel treefrog	*Hyla squirella*
eastern box turtle	*Terrapene carolina carolina*
eastern glass lizard	*Ophiosaurus ventralis*
skinks, several varieties	*Eumeces* spp.

3.7.3.2 Aquatic Species

The commonly found species for the affected areas for all alternatives within the Chattahoochee River system are detailed below.

Benthic Macroinvertebrates

The sensitivity of macroinvertebrates to changes in environmental quality render them an integral part of any biomonitoring program. Aquatic macroinvertebrates live on, under, and around rocks and sediment on the bottoms of lakes, rivers, and streams. Macroinvertebrates inhabit all types of running waters, from fast flowing mountain streams to slow-moving muddy rivers. Examples of aquatic macroinvertebrates include insects in their larval or nymph form, crayfish, clams, snails, and worms. Most live part or most of their life cycle attached to submerged rocks, logs, and vegetation. There are four feeding groups of aquatic macroinvertebrates: shredders, filter-collectors, grazers, and predators. Shredders such as stoneflies (plecoptera) feed on plant material and some animal material, which is generally dead, and break it into smaller particles through their feeding and digestive process. Collectors, such as caddisflies (trichoptera) and blackflies (diptera), feed on this fine particle material that they filter from the water. Grazers, such as snails and beetles, feed on algae and other plant material living on rocks and on plant surfaces. Predators such as dobsonflies (*magaloptera*) or dragonflies (*odonata*) feed on other macroinvertebrates. Individual species may be generalists, and fit into more than one of these groups (as opposed to specialists).

Insects

The free-flowing Upper Chattahoochee River has rich aquatic insect fauna, typical of the region. Stoneflies, such as *Paragnetina* spp., and mayflies, such as *Stenonema* spp. and *Baetis* spp., are common, as are net-spinning caddisflies (*Hydropsyche* spp. and *Cheumatopsyche* spp.). *Chironomid* midges, such as the net-spinning *Rheotanytarsus* spp., are also frequently encountered (Allan, 2005).

Freshwater Mollusks

The freshwater molluscan fauna of Georgia is one of the most diverse and abundant found anywhere in the world. Georgia's 165 mollusk species (67 snails and 98 mussels) rank fourth in total diversity. The majority of mussel species live in streams or rivers, but a few species can survive in lakes. Mussels live in a variety of stream beds, but most species prefer mixed sediments (sand-gravel-cobble) that are stable and free of silt (Johnson, 2013).

A protected species survey performed by University of Georgia's Institute of Ecology in 2003 identified one single eastern floater (*Pyganodon cataracta*) mussel within Flat Creek at the proposed Glades Reservoir dam location. (Assume the identified muscle is not protected…this sentence might lead one to think that it is.)

Crayfish

Crayfish can be found in a variety of habitats including streams, lakes, marshes, roadside ditches, cave systems, and even in burrows that are sometimes well away from open water. In Georgia, particularly the northern part of the state, most species inhabit streams. Georgia is home to approximately 70 species of crayfishes with 15 species located within the Chattahoochee River system (**Table 3.47**) (Skelton, 2014).

Table 3.47 Crayfishes of the Chattahoochee River System

Common Name	Scientific Name
thornytail crayfish	*Cambarus acanthura*
common crayfish	*Cambarus bartonii bartonii*
devil crawfish	*Cambarus diogenes*
piedmont blue burrower	*Cambarus harti*
Chattahoochee crayfish	*Cambarus howardi*
variable crayfish	*Cambarus latimanus*
knotty burrowing crayfish	*Cambarus nodosus*
ambiguous crayfish	*Cambarus striatus*
digger crayfish	*Fallicambarus fodiens*
ditch fencing crayfish	*Faxonella clypeata*
sharpnose crayfish	*Procambarus acutissimus*
peninsula crayfish	*Procambarus paeninsulanus*
white tubercled crayfish	*Procambarus spiculifer*
grainy crayfish	*Procambarus verrucosus*
sly crayfish	*Procambarus versutus*

Source: Skelton, 2014

Fish

There are over 325 freshwater fish species found in the state of Georgia, and 120 species have been identified with the Chattahoochee River Basin (Straight, 2009). Two fish surveys that have been conducted within the reservoir footprint, including one in 2010 and one in 2002. Based on these findings, no protected or rare species were identified; there is low potential for protected species to occur within the areas of the project alternatives.

3.7.4 Protected Species

Endangered Species Act Classifications

Species – any species or subspecies of fish, wildlife, or plant, excluding insects; also any variety of plant or any distinct population segment of any vertebrate species that interbreeds when mature

Endangered Species – species in danger of extinction within the foreseeable future in all or a significant portion of its range

Threatened Species – species likely to become endangered within the foreseeable future in all or a significant portion of its range

The following section summarizes the regulations, the protected species and species of concern that may be listed within the affected areas of the alternatives carried forward for further analysis, and field surveys that have been conducted to date. USFWS and the Georgia DNR were consulted in regards to those species having federal and or state protection as threatened, endangered, candidate, or potentially endangered (see agency correspondence in **Appendix S**).

Definition of "a take" according to the Endangered Species Act (ESA)

Wildlife killed or harmed during the construction or operation of any type of facility would be considered "a take." The Secretary of the Interior, through regulations, defined the term harm in this passage as "an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

3.7.4.1 Federally Listed Protected Species

The Endangered Species Act (ESA) of 1973 (16 U.S.C. §1531-1544) regulates a wide range of activities affecting flora and fauna classified as endangered or threatened. Reauthorized in 1988, provisions of the Act apply to species listed in the Federal Register as endangered or threatened. Actions affecting species proposed for listing would require the same coordination with state and federal agencies as those actions affecting listed species.

Under the provisions of the ESA, all federal agencies are required to undertake programs for conservation of threatened and endangered species and are prohibited from authorizing, funding, or carrying out any action that would jeopardize a listed species or destroy or alter its critical habitat. Wildlife killed or harmed during the construction or operation of any type of facility would be considered "a take." As defined in the ESA, the term take "means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." The Secretary of the Interior, through regulations, defined the term harm in this passage as "an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." Because it is unlawful to hunt or collect threatened and endangered species, habitat degradation is the primary reason for population declines in listed species (USFWS, 2001). The ESA also provides for the protection of habitat critical to the survival and recovery of the species and creation of a recovery plan for each listed species. The purpose of the ESA is to rebuild populations of protected species and conserve "the ecosystems upon which endangered and threatened species depend."

Table 3.48 lists the status of the federally protected species identified during the writing of this EIS as potentially occurring within the affected areas.

Critical Habitat

Critical habitat is a term defined and used in the ESA. It is a specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. Critical habitat may include an area that is not currently occupied by the species but that will be needed for its recovery. Official definition of critical habitat can be found in Section 3(5)(A) of the ESA.

There is no critical habitat established within the areas surrounding Glades Reservoir, White Creek Reservoir, or their associated transmission systems.

Table 3.48 Federal and State Protected Species potentially occurring within Affected Area

Common Name	Scientific Name	Federal Status[1]	State Status[2]	Hall County	Habersham County	White County	Georgia DNR 3-Mile Known Occurrence[3]
Mammals							
northern long-eared bat	*Myotis septentrionalis*	T	N/L*	X	X	X	No*
Indiana bat[4]	*Myotis sodalis*	E	E	X	X	X	No*
Birds							
bald eagle	*Haliaeetus leucocephalus*	XX	N	X	X	N/L	Yes
Fish							
Altamaha shiner	*Cyprinella xaenura*	N/L	T	X**	N/L	N/L	No
Halloween darter	*Percina crypta*	N/L	T	N/L*	X	X	Yes
Invertebrates							
Chattahoochee crayfish	*Cambarus howardi*	N/L	T	X	N/L	N/L	Yes
Edmund's snaketail	*Ophiogomphus edmundo*	N/L	E	N/L	N/L	X	No
Plants							
granite dome sedge	*Carex biltmoreana*	N/L	T	N/L	N/L	X	No
smooth coneflower	*Echinacea laevigata*	E	E	NL	X	X	No
goldenseal	*Hydrastis canadensis*	N/L	E	X	N/L	N/L	No
small whorled pogonia	*Isotria medeoloides*	T	T	N/L	X	N/L	No
black spored quillwort	*Isoetes melanospora*	E	N/L	X	N/L	N/L	No
sweet pinesap	*Monotropsis odorata*	N/L	T	X	X	N/L	No
monkey-face orchid	*Platanthera integrilabia*	C	T	N/L	X	N/L	No
purple pitcherplant	*Sarracenia purpurea*	N/L	E	N/L	X	X	No
Georgia aster	*Symphyotrichum georgianum*	C	T	X	X	X	No
Florida torreya	*Torreya taxifolia*	E	E	N/L	N/L	X	No

Common Name	Scientific Name	Federal Status[1]	State Status[2]	Hall County	Habersham County	White County	Georgia DNR 3-Mile Known Occurrence[3]
persistent trillium	*Trillium persistens*	E	E	N/L	X	N/L	No
Carolina hemlock	*Tsuga caroliniana*	N/L	E	N/L	X	N/L	No

Notes:
T = Threatened; E=Endangered; C=Candidate
X = Protected species potentially occurring within the county, N/L=Not Listed
XX = Although not designated as federally Threatened or Endangered, this species is protected under the Bald and Golden Eagle Protection Act of 1940, (16 U.S.C. 668-668d).
*According to the Georgia DNR, this species is not currently identified within the county database as a protected species; however, agency consultation has occurred for these species.
**Species is identified within the county, but it is not located in the Chattahoochee River Basin; therefore, this species would not occur within the affected area.
[1] Results of USFWS Information, Planning, and Conservation System (IPaC)
[2] Georgia DNR-Wildlife Resources Division (WRD) Elements of Occurrence (EO) list by County
[3] Georgia DNR 3-Mile Known Occurrence Response Letter Received on July 10, 2014
[4] Recent (June 2012) guidance from the USFWS has indicated that the southern summer range of the Indiana bat has been expanded to include Hall, Habersham, and White counties.

3.7.4.2 State Listed Species of Special Concern

Georgia's Endangered Wildlife Act of 1973 (O.C.G.A. 27-3-130) provides for identification, inventory, and protection of animal species that are rare, unusual, or in danger of extinction. The Board of Natural Resources approves changes to the list of state protected species. The protection offered to these species is limited to those that are found on state public lands. It is a misdemeanor to violate the rules prohibiting capture, killing, or selling of protected species, and protection of protected species habitat on public lands. The rules and regulations are established and administered by the Georgia DNR for implementation of this Act. Acquisition of unique habitats and natural areas for the protection of rare species is encouraged.**Table 3.48** summarizes the state listed species of special concern.

If there is potential habitat for species of concern within a site and those species are located within the USGS quarter quadrangle or quadrangles nearby, then a request for further information can be sent to the Georgia DNR in order to obtain the general location of protected species and/or communities of special concern. A request for known occurrences of natural communities, plants, and animals of highest priority conservation status for the alternative reservoir sites was sent to the Georgia DNR on May 12, 2014. The Georgia DNR response letter, received on July 10, 2014 (**Appendix S**), details the known occurrences of protected species for the alternative reservoir footprints and associated transmission main corridors.

3.7.4.3 Migratory Birds

The Migratory Bird Treaty Act (MBTA) and the Executive Order on the *Responsibility of Federal Agencies to Protect Migratory Birds* (EO 13186), requires the protection of migratory birds and their habitats. As directed under EO 13186, in furtherance of the MBTA (16 U.S.C. Sections 703-711), actions must be taken to avoid or minimize impacts to migratory bird resources and to prevent or abate the detrimental alteration of the environment for the benefit of migratory birds, as practicable. The MBTA protects over 1,500 migratory bird species (see 50 CFR 10.13, List of Migratory Birds) in the United States and its territories.

3.7.4.4 Bald and Golden Eagles

The Bald and Golden Eagle Protection Act (BGEPA) of 1940 (16 U.S.C. §668-668d, 54 Stat. 250), as amended, "provides for protection of the bald eagle and the golden eagle by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds" (USFWS, 2012). Under the BGEPA, the USFWS has the authority to issue permits to take, possess, and transport bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) for scientific, educational, and Indian religious purposes, depredation, and falconry (golden eagles) (USFWS, 2012). However, no permit issued authorizes the "sale, purchase, barter, trade, importation, or exportation of eagles, or their parts. Regulations that govern eagle permits are found in 50 CFR Part 13 (General Permit Procedures) and 50 CFR Part 22 (Eagle Permits) (Code of Federal Regulations, 2012).

Raptors such as ospreys and eagles mostly feed on fish and waterfowl and can be found near bodies of water such as rivers, ponds, reservoirs, and estuaries. They usually circle the sky over shallow bodies of water and hover before diving to catch prey. No eagle nests or preferred habitats were identified during the 2002 field survey for protected species or during the 2011 jurisdictional waters delineation of the Glades Reservoir site; however, the Georgia DNR records indicate one eagle nest was identified approximately 2.5 miles south of the reservoir footprint. No eagle nests were identified within 3 miles of the White Creek Reservoir footprint (**Appendix S**).

3.7.4.5 Essential Fish Habitat

The Magnuson-Stevens Act of 1976 (Public Law 94-265), amended in 1996 and reauthorized in 2006 (Public Law 109-479), provides for the conservation and management of fishery resources with a focus to rebuild overfished fisheries, protecting essential fish habitat and reducing bycatch (National Marine Fisheries Service [NMFS], 2012). The project site is not located in counties (Camden, Glynn, McIntosh, Liberty, Bryan, and Chatham) where essential fish habitat is designated for federal management. No further consultation with the NMFS will be required regarding essential fish habitat and the Magnuson-Stevens Fishery Conservation and Management Act.

3.7.4.6 Invasive Species

In response to the Non-Indigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA), the Georgia Invasive Species Advisory Committee (Committee) developed the Georgia Aquatic Nuisance Species Management Plan (GANSMP). The Committee developed a list of 102 Aquatic Nuisance Species (ANS) that are of concern to the agencies and organizations that work on ANS management issues in Georgia. These species were prioritized based on actual or perceived threat, as well as the amount of time and money a participating agency or organization currently devotes to management of the species. The Committee identified 71 aquatic species that have been introduced and are currently found in Georgia. Among the species found, 64% are categorized as Priority 1(a) species, 19% are categorized as Priority 2(a), and 16% are categorized as Priority 3(a). The Committee identified 31 aquatic species not currently found in Georgia that have a high probability of introduction and these were prioritized according to threats in an Aquatic Species Watch List. The Committee focused most of its attention on the 71 species that it considered to be established and pose the highest risk of causing harm.

While no single federal agency has authority over all aspects of ANS management, many agencies have programs and responsibilities that address aspects of the problem, such as importation, interstate transport, prevention, exclusion, control, and eradication. The Corps Engineering Research and Development Center (ERDC) operates an active Aquatic Nuisance Species Research Program with the goal of minimizing adverse impacts and maximizing control opportunities with respect to ANS. The ERDC also has an Aquatic Plant Control Research Program, which is the nation's only federally authorized research program directed to develop technology for the management of non-native aquatic plant species. In Georgia, the Corps' involvement in ANS management is primarily related to the occurrence of nuisance populations of aquatic plants in Corps-operated navigation and multi-purpose reservoir projects.

During the 2012 field survey effort on the Glades Reservoir site, dominant vegetation for all wetlands was recorded. There were no non-indigenous aquatic nuisance species noted within the inundated wetland that is the relic Glades Pond. The White Creek Reservoir site is privately owned and access for on-site field survey was not possible during this analysis, and there are no publicly available databases that indicate the presence of any non-indigenous aquatic nuisance species within the White Creek Reservoir's footprint.

3.7.4.7 Field Surveys

This section summarizes existing surveys previously conducted by others within the Glades Reservoir site, including one terrestrial and two fish surveys.

Terrestrial Field Surveys

Field surveys for threatened and endangered terrestrial species were conducted within the Glades Reservoir site in May and August 2002. These studies examined the Glade Farm property for the presence of listed species and their potentially suitable habitat. During the original survey the proposed site and alternatives were examined for two species which are no longer included in this report. During the 2002 survey habitat for pool sprite (*Amphianthus pusillus*) and mat-forming quillwort (*Isoetes tegetiformans*) was found within the Glades Shoals portion of the Glades alternative. After further review the conclusion was made that these species do not have a range that extends into Hall County or the other counties proposed as reservoir alternatives and it was decieded to remove these species from this report.

Protected Bats

The applicant conducted a bat survey in 2015 that was submitted to US Fish and Wildlife Service on September 2, 2015. The field summer habitat assessment, conducted by Eco-Tech on June 9, 2015, found approximately 38 percent of the study area was hardwood forest and provided the most suitable habitat for bats. These wooded areas are suitable for the federally endangered Indiana bat (*Myotis* *sodalis*) and the federally threatened northern long-eared bat (*M. septentrionalis*) roosting and foraging. Existing forested habitat and streams within the project study area may provide suitable foraging and/or flying corridors for Indiana bats and northern long-eared bats. No federally listed species were captured during the survey however, suspected calls of the federally listed Indiana bat, federally listed gray bat, and federally listed northern long-eared bat were recorded with ultrasonic bat detectors, although species-level classifications of these species could not be determined by manual analysis. Existing forest within the study area were comprised of suitable roosting and foraging habitat for Indiana bats and northern long-eared bats.

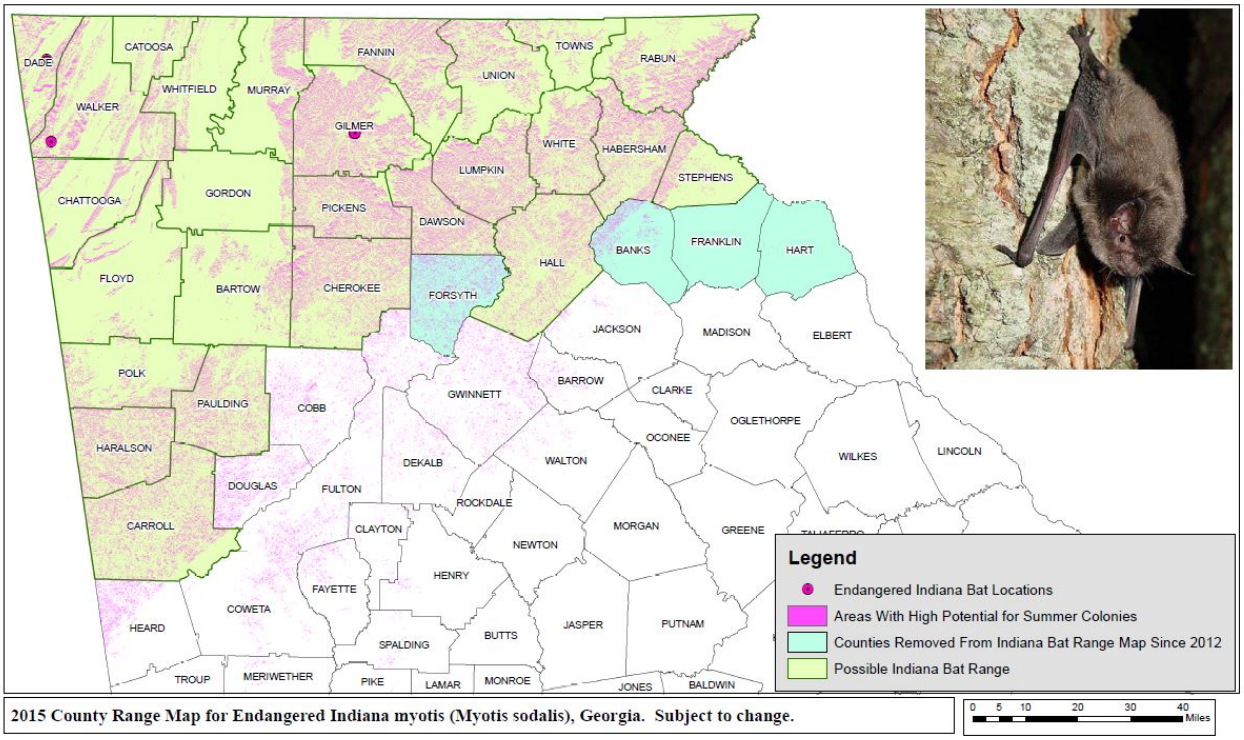
Indiana Bat

The Indiana bat (*Myotis sodalis*) is a federal and state endangered bat. The Indiana bat is a medium-sized Myotis, closely resembling the little brown bat (*Myotis lucifugus*) but differing in coloration. Its fur is a dull grayish chestnut rather than bronze, with the basal portion of the hairs on the back a dull-lead color. This bat's underparts are pinkish to cinnamon, and its hind feet are smaller and more delicate than in *M. lucifugus*. The calcar (heel of the foot) is strongly keeled. Indiana bats gather in large groups in suitable caves to hibernate, more than 85% of the population in just nine caves in Indiana, Missouri, and Kentucky. These bats need winter caves with a stable temperature of 4 - 8°C (39 - 46°F) that contain standing water which maintains relative humidity above 74%. The bats usually cluster fairly near the entrance and awaken periodically throughout the winter. During the summer, Indiana bats roost in trees, usually under loose, exfoliating bark as found on shagbark hickories and dead hardwoods, or in hollow trees. The roost sites are typically at a woodland edge where the tree is warmed by the sun. The bats forage in the surrounding riparian, floodplain, and upland forest, and sometimes over open areas and water as well. Indiana bats have been documented in 19 states including Georgia (**Figure 3.40**).

The Indiana bat was listed as endangered in 1967 due to episodes of people disturbing hibernating bats in caves during winter, resulting in the death of large numbers of bats. Indiana bats are vulnerable to disturbance because they hibernate in large numbers in only a few caves (the largest hibernation caves support from 20,000 to 50,000 bats). Other threats that have contributed to the Indiana bat's decline include commercialization of caves, loss of summer habitat, pesticides and other contaminants, and most recently, the disease white-nose syndrome.

The affected area for the Proposed Project and alternatives are within the potential summer range of the Indiana bat. Older regrowth deciduous forests contain potentially suitable summer roost trees for this species, primarily older white oaks and shagbark hickories. Coordination with USFWS has determined the need for future bat surveys to be performed for any project alternative closer to the construction start date in order to assess potential habitat areas (see **Appendix S** for agency coordination). It is USFWS's recommendation that a baseline survey be performed in the early planning stages of the project and that a follow-up survey be performed closer to the start of construction. The White Creek alternatives are privately owned and access for on-site field survey was not possible within the scope of this analysis; however, if this alternative is chosen, a protected species survey will need to be performed and subsequent surveys for protected bat species will also be completed.

Figure 3.40 Locations of Indiana Bats in Georgia



2015 County Range Map for Endangered Indiana myotis (Myotis sodalis), Georgia. Subject to change.

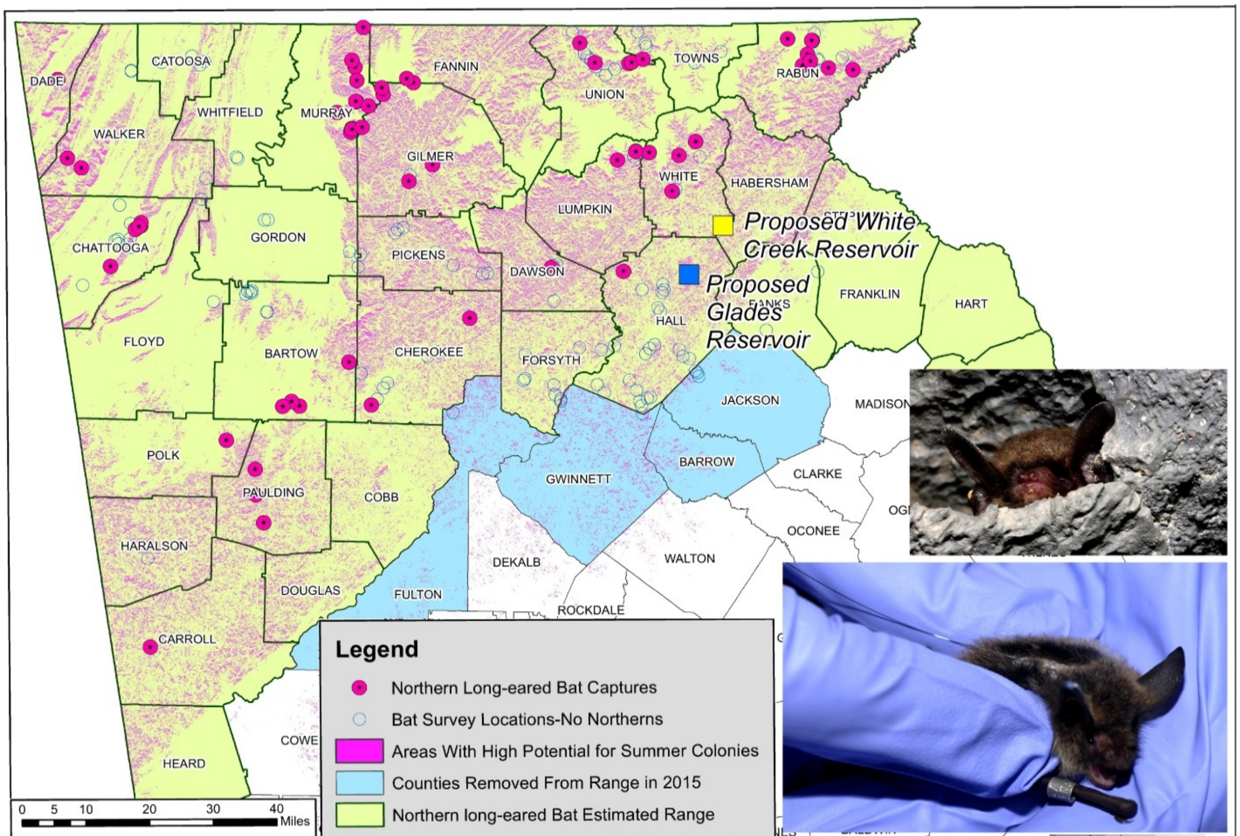
Northern Long-Eared Bat

The Northern long-eared bat (*Myotis septentrionalis*) is recently listed as a federal threatened species (April 2, 2015).

The northern long-eared bat is a medium-sized bat, about 3 to 3.7 inches long but with a wingspan of 9 to 10 inches. As its name suggests, it is distinguished by its long ears, particularly as compared to other bats in its genus, Myotis. It eats insects and emerges at dusk to fly through the understory of forested hillsides and ridges feeding on moths, flies, leafhoppers, caddisflies, and beetles, which it catches while in flight using echolocation. The northern long-eared bat is found across much of the eastern and north central United States and all Canadian provinces from the Atlantic coast west to the southern Northwest Territories and eastern British Columbia. The species' range includes the following 37 states including Georgia (**Figure 3.41**) Northern long-eared bats spend winter hibernating in caves and abandoned mines, collectively call hibernacula. During summer, they roost alone or in small colonies underneath bark or in cavities or crevices of both live trees and snags (dead trees).

All alternatives carried forward for further evaluation are within the potential summer range of the northern long-eared bat, with one recorded occurrence identified in western Hall County and three additional records in north western White County. Coordination with the USFWS has determined the need for future bat surveys to be performed for the selected project alternative closer to the construction start date in order to assess potential habitat areas (see **Appendix S** for agency coordination). USFWS recommends that a baseline survey be performed in the early planning stages of the project and that a follow-up survey be performed closer to the start of construction.

Figure 3.41 Locations of Northern Long-Eared Bats in Georgia



2015 County Range Map for Northern long-eared myotis *(Myotis septentrionalis)*, Georgia. Subject to change.

Black Spored Quillwort

Black spored quillwort (*Isoetes melanospora*) is a federally listed endangered species. It is a perennial herb that prefers shallow, ephemeral, flat-bottomed pools formed by natural erosion on granite outcrops. The plants are visible throughout the winter and spring and following rainy periods in the summer (Chafin, 2008).

During the 2002 field surveys of the Glades Reservoir alternative, potentially suitable habitat was found to exist for the black spored quillwort. Located on the extreme northwest portion of the property is a granite outcrop referred to as Glades Shoals. This outcrop is relatively flat at the top and then drops off steeply. Flat Creek flows across the western edge of this outcrop. There are numerous scalloped pools on the flat portion of the outcrop that receive water from Flat Creek and surface runoff. These pools were of varying size and depth. Most of the larger pools appear to retain water for extended periods. Some deeper pools located near Flat Creek supported larval amphibians.

These federally protected species are identified within either the USFWS or Georgia DNR databases as potentially occurring within Hall County, Georgia. Therefore, the presence of these species is unlikely and it is not anticipated that these species will encountered within the affected areas of the Proposed Project and alternatives.

Florida Torreya

Florida torreya (*Torreya taxifolia*) is a federal and state listed endangered plant that is endemic to a small area in southwest Georgia and adjacent areas along the Apalachicola River in north Florida (Chafin, 2009). No individual species or potential habitat for Florida torreya were identified during the 2002 field survey for protected species nor during the 2011 jurisdictional waters delineation of the Glades Reservoir site.

Georgia Aster

Georgia aster (*Symphyotrichum georgianum*) is a federal candidate and state threatened plant species that prefers circumneutral soils located along edges and openings in rocky, upland oak-hickory-pine forests, and rights-of-way through these habitats. Surveys are best conducted during flowering (late September through mid-November). In Georgia, about 30 populations have been observed but only 15 small populations have survived; 8 of these occur in state parks or on national forestlands (Chafin, 2010). No individual species or potential habitat for Georgia aster were identified during the 2002 field survey for protected species nor during the 2011 jurisdictional waters delineation of the Glades Reservoir alternative.

Monkey-Face Orchid

The monkey-face orchid (*Platanthera integrilabia*) is a federal candidate and state threatened plant species. This species prefers acidic mucks or sands in wetland areas, usually red maple-gum swamps, peaty seeps and streambanks, seepage sphagnum bogs, springheads, and seepy stream banks. It is often noted growing with primrose-leaved violet, green woodland orchid, cowbane, and grass of-Parnassus. No individual species or potential habitat for monkey-face orchid were identified during the 2002 field survey for protected species nor during the 2011 jurisdictional waters delineation of the Glades Reservoir site.

Persistent Trillium

Persistent trillium (*Trillium persistens*) is a federal and state listed endangered plant that prefers pine-hemlock-hardwood forests in ravines or along streams. Persistent trillium is a long-lived plant, perhaps living hundreds of years as the rhizome continues to lengthen (Chafin, 2009). No individual species or potential habitat for persistent trillium were identified during the 2002 field survey for protected species nor during the 2011 jurisdictional waters delineation of the Glades Reservoir site.

Small Whorled Pogonia

Small whorled pogonia (*Isotria medeoloides*) is a federal and state listed threatened plant that prefers acidic soils of mixed hardwood-pine forests on lower slopes and stream terraces. Small whorled pogonia emerges from winter dormancy in April and flowers through May (Chafin, 2007). No individual species or potential habitat for small whorled pogonia were identified during the 2002 field survey for protected species nor during the 2011 jurisdictional waters delineation of the Glades Reservoir site.

Smooth Coneflower

Smooth coneflower (*Echinacea laevigata*) is a federal and state listed endangered species that prefers sunny roadsides and rights-of-ways through habitats with grassy openings and rocky glades with shallow soil over mafic bedrock. Flowering occurs from mid-May through July and fruiting occurs from July through October (Chafin, 2007). No individual species or potential habitat for smooth coneflower were identified during the 2002 field survey for protected species nor during the 2011 jurisdictional waters delineation of the Glades Reservoir site.

Aquatic Field Surveys

Field surveys for threatened and endangered aquatic species were conducted within Flat Creek within the Glades Reservoir footprint in 2002 and an additional survey was conducted within the Chattahoochee River in the vicinity of the Glades Reservoir site in 2010. These studies examined the Glades Farm property for the presence of listed species and their potentially suitable habitat. Two fish surveys have been conducted within the affected areas, including one on September 21, 2010, within the Chattahoochee River and one on August 21 to August 27, 2002, within Flat Creek and its tributaries.

Halloween Darter

The Halloween darter (*Percina crypta*) is a federal candidate fish species. It inhabits riffles or shoals in the Flint and Chattahoochee River mainstems and larger tributaries to these rivers. It prefers shallow, swift-flowing habitats over cobble, gravel, and bedrock, and often in association with the aquatic plant, riverweed (*Podostemum ceratophyllum*). This species spawns during April and May (Freeman, 2008).

Although no Halloween darters were observed within the 2002 or 2010 aquatic surveys, preferred habitat for this species was identified at three shoal locations within the Chattahoochee River downstream of the Glades Reservoir raw water intake location. No action is needed for this species currently; however, if the federal designation of this species changes from Candidate to Threatened or Endangered in the future, further coordination with USFWS would be needed. The change of listing status would likely stipulate the need for future aquatic surveys to be performed closer to the construction start date of the selected alternative in order to assess these potential habitat areas (**Appendix S**).

Fish Survey 2002

A series of aquatic protected species surveys were performed by University of Georgia's Institute of Ecology in 2002 within the Flat Creek watershed in order to assess the aquatic community of Flat Creek and its major tributaries in the vicinity of the Glades Reservoir site (Straight et al., 2003). This survey focused on protected species that could occur in this watershed, but also collected information on all fish species encountered. Four mainstem locations were sampled in August 2002, including two on Flat Creek (one at the proposed dam site and one upstream of Romey Road) and two unnamed tributaries to Flat Creek. This survey utilized a Smith Root Model 12B POW backpack electrofisher, dip nets, and a seine. Sample lengths were determined using protocols of the Georgia Department of Natural Resources (DNR) (GDNR 2000), which specify quantitative electrofishing of a reach length 35 times the mean stream width, with a minimum reach length of 100m. Sampling efforts involved utilizing a single backpack shocker and employing kick seining along with seine hauling, which increases sampling effectiveness, especially for benthic species. All surveys were conducted in an upstream direction.

At the time of the survey, the bluestripe shiner (*Cyprinella callitaenia*), highscale shiner (*Notropis hypsilepis*), Halloween darter (*Percina crypta*), and shoal bass (*Micropterus cataractae*) were identified as protected fish and fish species of concern in the Upper Chattahoochee Basin. Threatened and endangered species will be discussed further in Section 3.7.4 – Protected Species. No rare or protected fish species were identified during these surveys performed in 2002. The survey results from each of the four sampling locations are detailed in **Table 3.49** through **Table 3.52**.

Table 3.49 Fishes Collected from Flat Creek at the Proposed Glades Reservoir Dam Site

Scientific Name	Common Name	Total
Dorosoma cepedianum	gizzard shad	1
Cyprinus carpio	common carp	4
Campostoma pauciradii	bluefin stoneroller	125
Semolilus thoreauianus	Dixie chub	3
Nocomis leptocephalus	bluehead chub	222
Nocomis micropogon	river chub	6
Notropls hudsonius	spottail shiner	139
Notropis lutipinnis	yellowfin shiner	353
Pimephales promelas	fathead minnow	1
Hypentelium etowanum	Alabama hogsucker	38
Scartomyzon lachneri	greater jumprock	1
Ameiurus brunneus	snail bullhead	50
Ameiurus nebulosus	brown bullhead	15
Amelurus platycephalus	flat bullhead	6
Noturus gyrinus	tadpole madtom	2
Micropterus cataractae	shoal bass	2
Micropterus punctulatus	spotted bass	1
Micropterus salmoides	largemouth bass	25
Lepomis auritus	redbreast sunfish	44
Lepomis gulosus	warmouth	8
Lepomis macrochirus	bluegill	21
Percina nigrofasciata	blackbanded darter	156

Source: Straight et al., 2003

Table 3.50 Fishes Collected from Unnamed Tributary to Flat Creek Upstream of Proposed Glades Reservoir Dam Site

Scientific Name	Common Name	Total
Campostoma pauciradii	bluefin stoneroller	29
Semotilus thoreauianus	Dixie chub	11
Nocomis leptocephalus	bluehead chub	132
Notropis lutipinnis	yellowfin shiner	394
Notropis hudsonius	spottail shiner	26
Hypentelium etowanum	Alabama hogsucker	22
Ameiurus brunneus	snail bullhead	25
Cottus sp. cf. carolinae	sculpin species	40
Micropterus salmoides	largemouth bass	25
Lepomis auritus	redbreast sunfish	37
Lepomis macrochirus	bluegill	6
Lepomis cyanellus	green sunfish	1
Perea flavescens	yellow perch	2
Percina nigrofasciata	blackbanded darter	87

Source: Straight et al., 2003

Table 3.51 Fishes Collected within Flat Creek Upstream of Glades Reservoir Dam Site off Romey Savage Road

Scientific Name	Common Name	Total
Campostoma pauciradii	bluefin stoneroller	23
Semotilus thoreauianus	Dixie chub	9
Nocomis leptocephalus	bluehead chub	117
Nocomis micropogon	river chub	5
Notropis lutipinnis	yellowfin shiner	579
Hypentelium etowanum	Alabama hogsucker	21
Scartomyzon lachneri	greater jumprock	1
Ameiurus brunneus	snail bullhead	3
Ameiurus platycephalus	flat bullhead	1
Cottus sp. cf. carolinae	sculpin species	19
Micropterus salmoides	largemouth bass	14
Lepomis auritus	redbreast sunfish	35
Lepomis cyanellus	green sunfish	3
Lepomis macrochirus	bluegill	1
Perclna nigrofasciata	blackbanded darter	46

Source: Straight et al., 2003

Table 3.52 Fishes Collected from Unnamed Tributary to Flat Creek Upstream of Glades Reservoir Dam Site

Scientific Name	Common Name	Total
Campostoma pauciradii	bluefin stoneroller	29
Semotilus thoreauianus	Dixie chub	88
Nocomis jeptocephalus	bluehead chub	99
Notropis jutipinnis	yellowfin shiner	377
Cottus sp. cf. *carolinae*	sculpin species	1

Source: Straight et al., 2003

Fish Survey 2010

In 2010, the Hall County Board of Commissioners contracted with CCR Environmental, Inc. to perform a study of potential impacts of water withdrawals on the fish community in the Chattahoochee River in Hall County, Georgia (CCR Environmental, Inc., 2010). The study area/reach extended approximately 6.3 miles from the proposed water intake for the Glades Reservoir to the Lula Bridge at SR 52.

The study was conducted in three phases. Phase 1 consisted of site reconnaissance and study reach habitat characterization. The purpose of this phase was to map aquatic habitat (i.e., shoal/riffle, run, and pool) in the study reach, quantify the amount of such habitat in the reach, and determine the location of critical areas that would be particularly sensitive to flow levels, i.e., shoal and shallow run areas. Phase 2 consisted of the survey of the study reach to determine the composition of the fish community within the study area. A fish survey was performed within the three basic aquatic habitat types within the affected area: pool habitat, run habitat, and shoal habitat. Boat electrofishing was conducted on September 21, 2010, for approximately 2,000 feet in each habitat type. Phase 3 consisted of the critical areas assessment. This phase assessed incremental impacts of various flows, principally annual and monthly 7Q10 (lowest annual 7-day average flow that occurs once in 10-year flows), on aquatic habitat and select fish species and life stages in the critical areas.

The Phase 2 results demonstrated that the fish communities within each habitat type varied (**Table 3.53**). The shoal habitat survey results demonstrated the most abundant, diverse fish community relative to the other habitat types. A total of 14 species were collected in this habitat and the fish community was dominated by minnows (family *Cyprinidae*), including the state protected (rare) bluestripe shiner (*Cyprinella callitaenia*). Run habitat survey results demonstrated the least abundant, diverse fish community. A total of 7 species were collected in this habitat and the fish community was dominated by suckers (family *Catostomidae*). Pool habitat survey results demonstrated a medium range of species compared to the other habitat types. The fish community in the pool habitat had 10 species and was dominated by sunfish and black basses (family *Centrarchidae*). The greater jumprock was the only species collected in all three habitat types.

Table 3.53 Fish Species and Abundance by Habitat Type – Chattahoochee River from Proposed Glades Reservoir River Intake to Lula Bridge

Scientific Name	Common Name	Shoal	Run	Pool
Hypentelium etowanum	Alabama hogsucker	C		
Minytrema melanops	spotted sucker		C	R
Moxostoma sp.	Apalachicola redhorse		A	
Scartomyzon lacheri	greater jumprock	R-C	C	R
Lepomis auritus	redbreast sunfish	R		C
Lepomis macrochirus	bluegill sunfish	R		A
Lepomis microlophus	redear sunfish			R-C
Micropterus cataractae	shoal bass	R		
Micropterus punctulatus	spotted bass	R		R
Micropterus salmoides	largemouth bass			R-C
Dorosoma cepedianum	gizzard shad			R-C
*Cyprinella callitaenia**	bluestripe shiner	R		
Cyprinella venusta	blacktail shiner	C	R	
Cyprinus carpio	common carp		C	R-C
Nocomis leptochepalus	bluehead chub	R		
Notropis hudsonius	spottail shiner	C		R
Notropis longirostris	longnose shiner	A		
Ictalurus punctatus	channel catfish	R	R-C	
Pylodictus olivarus	flathead catfish	R		
Percina nigrofasciata	blackbanded darter	R	R	

Notes:
R = Rare (< 5% of collection)
C = Common (10% - 25% of collection)
A = Abundant (> 25% of collection)
*State rare species
Source: CCR Environmental, Inc., 2010

3.8 Socioeconomic Conditions

Socioeconomics is the combination of social and economic factors such as population, housing, income, employment, environmental justice, recreation, etc. Information for this section was collected from entities such as the U.S. Census Bureau, local county comprehensive plans and websites, Georgia Department of Labor (GDOL), and Georgia Department of Transportation (GDOT). These sources provide information on a national, regional, state, local, and site-specific level. The majority of the area affected by the alternatives carried forward for further analysis is located in Hall County; the affected area also includes a small area in the southeastern corner of White County and the very southwestern corner of Habersham County in northeast Georgia.

Environmental Justice

The Proposed Project is being evaluated in accordance with Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* and with EO 13166, *Improving Access to Services for Persons with Limited English Proficiency*.

EO 12898 requires federal agencies to achieve environmental justice by identifying and addressing disproportionately high and adverse human health or environmental effects, including the interrelated social and economic effects of their programs, policies, and activities on minority populations and low-income populations.

EO 13166 requires federal agencies to examine the services they provide, identify any need for services to those with limited English proficiency (LEP), and develop and implement a system to provide those services so LEP persons can have meaningful access to them.

3.8.1 Demographics and Environmental Justice

This section provides an overview of general demographic data and presents the Environmental Justice evaluation of population demographic information, including minority and low-income populations, using localized data from the U.S. Census Bureau.

3.8.1.1 Glades Reservoir Alternatives

The Glades Reservoir site is located entirely within Hall County. Hall County and its county seat, Gainesville, have grown rapidly during the last two decades. During the period of 1990 to 2010, the population nearly doubled from 95,428 to 179,684 with a strong demand for new housing (Gainesville-Hall County Comprehensive Plan, 2005 [latest available plan]). These communities have also experienced significant demographic changes associated with employment within the poultry processing industry. The county's Hispanic population has increased from 5% in 1990 to 26% in 2010 and is expected to continue to grow. One of the demographic changes is that the population is aging. Situated approximately 70 miles from Atlanta, through its geographic proximity to Atlanta, Hall County serves as a bedroom community of Atlanta, just north of Gwinnett County, which is located in the Atlanta Regional Commission's 10-county Atlanta area. Hall County retains a combination of suburban, urban, and rural settings, and draws tourists and recreationalists due to Lake Lanier and its close drive to the mountains.

Detailed discussions of historical and projected population growth and trends in Hall County are presented in Section 1.6.1 Population Projections and its appendices

(Technical Memorandum – Review of Available Population Projections for Hall County, GA, May 6, 2013, AECOM, and Technical Memorandum – Revised Population projections for Hall County, GA, May 31, 2014, AECOM).

Table 3.54 provides a demographic overview for the 3-county area affected by the alternatives carried forward for further analysis, including population, age, average household size, housing, education, language, etc. According to the 2010 census, Hall County is six times more populous than White County and four times more populous than Habersham County. Hall County also has a much higher percentage of foreign-born population than the state of Georgia and the neighboring White or Habersham counties.

Low-income data were obtained from the U.S. Census Bureau's American Community Survey five-year Estimates for 2008–2012 (**Table 3.55**), and minority data (**Table 3.56**) were obtained from the U.S. Census. The level of data for both low-income and minority population characteristics was determined at the Census block group level, which is the smallest geographic level for which these data are available. Minority is defined as a race and ethnicity other than people who identify themselves as non-Hispanic White alone. Examples of minority populations include African American, Hispanic or Latino, and Asian American. Overall, the percentage of population considered low-income is higher in White and Habersham counties than in Hall County. The Glades Reservoir site has a slightly lower percentage poverty population (lower than county average and state average), while the White Creek Reservoir Census Tract has a poverty population higher than Hall County and state averages. (The last sentence in the paragraph is misleading. I don't think anyone lives on or directly adjacent to the Glades reservoir site. Maybe it should read "in the general vicinity of the Reservoir site.")

River Transmission System

The river transmission main associated with the Glades Reservoir begins northeast of the reservoir at the Chattahoochee River and travels southeast through a mostly rural residential area with several commercial chicken house operations scattered throughout. Approximately 15% of the transmission main will travel through undeveloped woodlands, with the remaining portion of the transmission lines travelling adjacent to the existing roadway right-of-way along Persimmon Tree Road, SR 52, and Glade Farm Road. The transmission main to Glades Reservoir will run adjacent to an existing right-of-way and will be buried underground. The majority of this area is rural undeveloped lands, with limited population.

Reservoir Site

The Glades Reservoir site is located in rural unincorporated Hall County, in primarily undeveloped lands with few residences in the immediate vicinity. One road, Glade Farm Road, passes through the proposed reservoir site. The Glades Reservoir intersects one census tract with three block groups within Hall County, as depicted in **Figure 3.42**. In 2000, Hall County's population was 72% White, 20% Hispanic, 7% Black/African American; approximately less than 1% was Native American; and 1% of the population was Asian or Pacific Islander. According to census data provided in the Gainesville-Hall County Comprehensive Plan in 1990, 1,355 persons of Hispanic origin lived in Gainesville, which was equivalent to 29% of the total Hispanic population in Hall County. In 2000, according to Census data, 8,423 persons of Hispanic origin were living in Gainesville, which equates to 31% of the total Hispanic population in Hall County. Conversely, the African American population in Hall County has become slightly less concentrated within Gainesville since 1990.

Population demographic data are shown in **Table 3.54** through **Table 3.56**. Census Tract 201 block group 3 has a Hispanic population approximately equal to the county's Hispanic population of 26%. The low-income population of the census tracts for Glades Reservoir is lower than the low-income population of Hall County.

Table 3.54 Demographic Overview (2008–2012)

Demographic Category	Georgia	Hall County	White County	Habersham County
Total Population	9,714,569	180,831	27,144	43,038
Median Age (years)	35.4	34.5	43.2	38.6
Average Household Size	2.70	2.90	2.52	2.71
Total Housing Units	4,086,231	68,511	15,765	18,118
Occupied Housing Units	3,508,477	60,994	12,154	14,890
Owner-Occupied Housing Units	2,315,287	41,850	9,040	11,345
Renter-Occupied housing Units	1,193,190	19,144	3,114	3,545
School Enrollment (Age 3+)	2,716,041	47,171	5,940	10,909
Percent High School Graduate or Higher	84.4%	78.5%	85.1%	78.9%
Residence 1 Year Ago – same house	7,989,310	152,796	24,484	38,639
Foreign Born	939,564 (9.6%)	28,262 (15.6%)	545 (2.0%)	3,610 (8.4%)
Language other than English and Speak English less than 'very well'	521,357 (5.4%)	23,392 (12.9%)	228 (0.8%)	2,508 (5.8%)

Source: American Community Survey, 2008–2012, 5-year estimate

Table 3.55 Low-Income Population Data

	Total Population	Poverty Population	% Poverty
Georgia	9,687,653	1,685,651*	17.4%*
Glades Reservoir			
Hall County (2008–2012)	176,582	29,747	16.8%
Glades Census Tract 000201	5,909	913	15.5%
White Creek			
White County (2008–2012)	26,619	4,587	17.2%
White Creek Census Tract 950300	8,154	1,555	19.1%
Habersham County (2008–2012)	40,256	7,287	18.1%

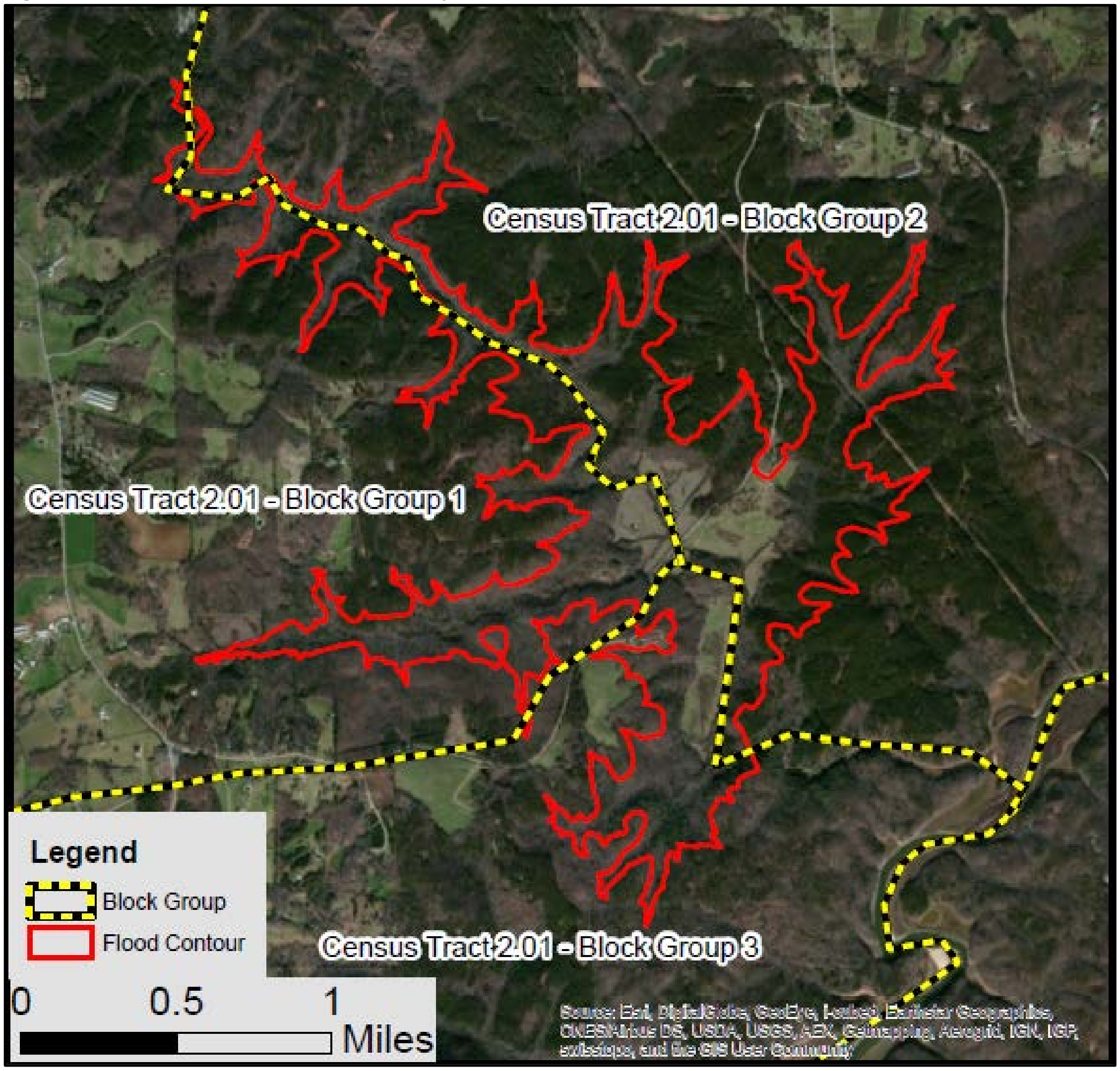
Notes:
*Based on 2008–2012 American Community Survey Data.
The 2010 decennial data is only available by Census Tract, which is the smallest population unit available for the low-income data as of 4/3/14.

Table 3.56 Alternatives and Demographic Data

	Total Population	White	Black or African American	American Indian Alaskan Native	Asian	Native Hawaiian or Other Pacific Islander	Some Other Race	Two or More Races	Hispanic or Latino
Population (Georgia)[1]	9,687,653	59.74% 5,787,440	30.46% 2,950,435	0.33% 32,151	3.25% 314,467	0.07% 6,799	4.01% 388,872	2.14% 207,489	8.81% 853,689
Glades Reservoir									
Population (Hall County)[1]	179,684	74.13% 133,197	7.39% 13,279	0.45% 811	1.80% 3,226	0.09% 167	13.94% 25,042	2.20% 3,962	26.10% 46,906
Glades Census Tract 000201 / BG 1	1,629	95.21% 1,551	0.80% 13	0.80% 13	0.06% 1	0.00% 0	1.78% 29	1.35% 22	5.34% 87
Glades Census Tract 000201 / BG 2	1,406	97.72% 1,374	0.28% 4	0.14% 2	0.14% 2	0.00% 0	0.85% 12	0.85% 12	3.77% 53
Glades Census Tract 000201 / BG 3	2,907	80.43% 2,338	1.00% 29	0.21% 6	0.48% 14	0.03% 1	16.00% 465	1.86% 54	26.14% 760
White Creek Reservoir									
Population (White County)[1]	27,144	95.14% 25,824	1.68% 457	0.48% 131	0.46% 124	0.03% 9	0.85% 230	1.36% 369	2.38% 647
White Creek Census Tract 950300 / BG 1	860	96.98% 834	0.47% 4	0.23% 2	0.00% 0	0.00% 0	1.51% 13	0.81% 7	1.98% 17
Population (Habersham County)[1]	43,041	85.72% 36,893	3.35% 1,444	0.45% 195	2.23% 960	0.15% 65	6.30% 2,713	1.79% 771	12.39% 5,333

Notes:[1] Population counts and percentages represent that group alone and are not additive.
Source: 2010 Census, Fact Finder

Figure 3.42 Glades Reservoir Block Groups for Census Tract 000201



Reservoir Transmission System

The transmission main for delivering raw water from Glades Reservoir to the Lakeside WTP begins on the central-eastern side of the reservoir and travels southeast and then southwest through a mixed commercial and residential area in Hall County. Approximately 5% of the transmission main will travel through undeveloped woodlands; approximately 6% of the transmission main will travel within an already existing utility right-of-way; and the remaining 89% of the transmission pipeline will travel adjacent to the existing roadway right-of-way along SR 52, Cornelia Highway, and I-985 and will be buried underground. The majority of the affected area is rural and commercial, with limited residential populations. The booster pump station would be situated on approximately 1 acre of undeveloped lands adjacent to existing roadway right-of-way outside of residential neighborhoods.

The transmission main for delivering water to the new Glades Reservoir WTP would be through primarily wooded forest. Scattered residences occur within this area.

3.8.1.2 White Creek Reservoir Alternatives

White Creek Reservoir and its river intake are located in White County, while the transmission mains pass through White, Habersham, and Hall counties. According to the White County Comprehensive Plan, in the period from 1990 to 2000, White County was identified as one of the fifty fastest growing counties in the country, having almost doubled its population from the previous decade. The City of Cleveland is the most populous area in White County, with over half of the population of the county. As a popular location for recreation, the northern portion of the county has developed in conjunction with the construction of vacation homes. The Comprehensive Plan describes the southern part of the county as potentially serving as a bedroom community associated with the proximity of employment centers located in Hall and Habersham counties. Seasonal tourism in White County can become an important factor in population estimates; the City of Cleveland, for example, can experience from 500 to 3,000 tourists per day.

The Habersham County Community Assessment identifies Habersham County as evolving into more of a bedroom community, with residents commuting outside of the county to work centers, including Hall County. According to the Habersham County Community Assessment, the county's population is expected to reach 89,000 by 2029. Between 1990 and 2000, Habersham County's population grew approximately 3.0%; while during 2000 through 2005, the county grew 2.1%. Average commute times have increased from 1990 to 2000, in conjunction with a reduction in the percentage of residents with commute times less than 20 to 24 minutes and the increase in the percentage of residents with commute times greater than 25 minutes. As with Hall County, one of the upcoming demographic issues for the county is to address needs and services for the aging population.

Issues noted under Glades Reservoir for Hall County are also all applicable for this site. **Table 3.54** through **Table 3.56** provide data for the White Creek Reservoir demographics.

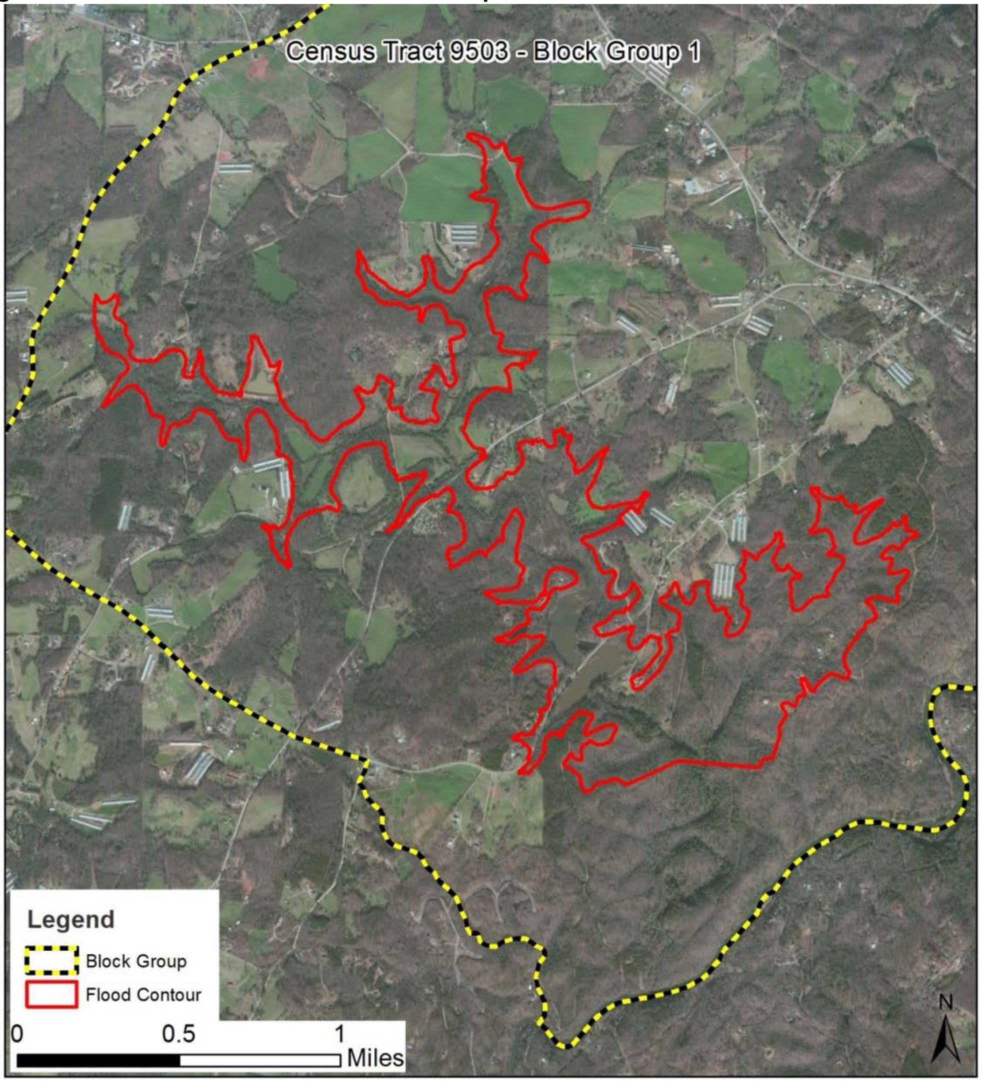
River Transmission System

The raw water intake, pump station, and transmission main associated with White Creek Reservoir begins at the southeast corner of the reservoir and travels approximately 0.5 mile to the southeast through a residential area within White County. The entire transmission pipeline will travel adjacent to an existing roadway right-of-way along Ashley Drive and will be buried underground. The majority of this area is rural undeveloped lands, with limited population.

Reservoir Site

White Creek Reservoir is located in rural unincorporated White County in primarily undeveloped lands with residential, chicken houses, and farmlands in the immediate vicinity. White Creek Reservoir intersects one census tract with one block group within White County, as depicted in **Figure 3.43**. As of the 2010 census, White County had a Hispanic population of 2.4%, which is an increase over the 2000 census of 1.6%. Population demographic data is shown in **Table 3.54** through **Table 3.56**. The percentage of low-income population of the census tract for White Creek Reservoir exceeds the overall low-income percentage in White County.

Figure 3.43 White Creek Reservoir Block Group for Census Tract 950300



Reservoir Transmission System

The transmission main from the reservoir to the Lakeside WTP begins on the southwestern corner of the reservoir and travels southeast through a mixed commercial and residential area. Approximately 2% of the transmission main is located in White County; approximately 9% is located in Habersham County; and the remaining 89% is located in Hall County. Less than 1% of the transmission main from White Creek Reservoir to the Lakeside WTP will be located in a river crossing (i.e., the Chattahoochee River); 6% of the transmission main will be located within existing utility right-of-way; and the remaining 93% of White Creek Reservoir to Lakeside WTP transmission mains will be located adjacent to existing roadway rights-of-way along Crow Bridge Road, Pea Ridge Road, Belton Bridge Road, Cornelia Highway, and Interstate 985. Approximately 31 miles of transmission main would extend from the reservoir to the Lakeside WTP located in Flowery Branch. The transmission main will be buried underground. The booster pump station would be situated on approximately 1 acre of undeveloped lands adjacent to existing roadway right-of-way outside of residential neighborhoods.

3.8.2 Housing, Communities, and Transportation

The communities in the vicinity of each alternative reservoir site and river and reservoir transmission systems (i.e., pump stations and transmission mains) are discussed below. Each alternative has an associated figure that illustrates the existing roadways and structures (i.e., residential structures, chicken houses, garages/barns, schools, commercial buildings, fire departments, convenience stores, and churches) within the area. Structures were identified using field data collected in 2014 and aerial photography on Google Earth Pro (2014). The reservoir site will constitute the majority of the discussion, since this is the area with the largest project footprint. The transmission mains will be underground utilities and are not anticipated to disrupt communities in a permanent manner.

3.8.2.1 Glades Reservoir Alternatives

River Water Transmission System

The river water transmission main will run predominantly adjacent to existing roadway right-of-way or through undeveloped woodlands and will be buried underground.

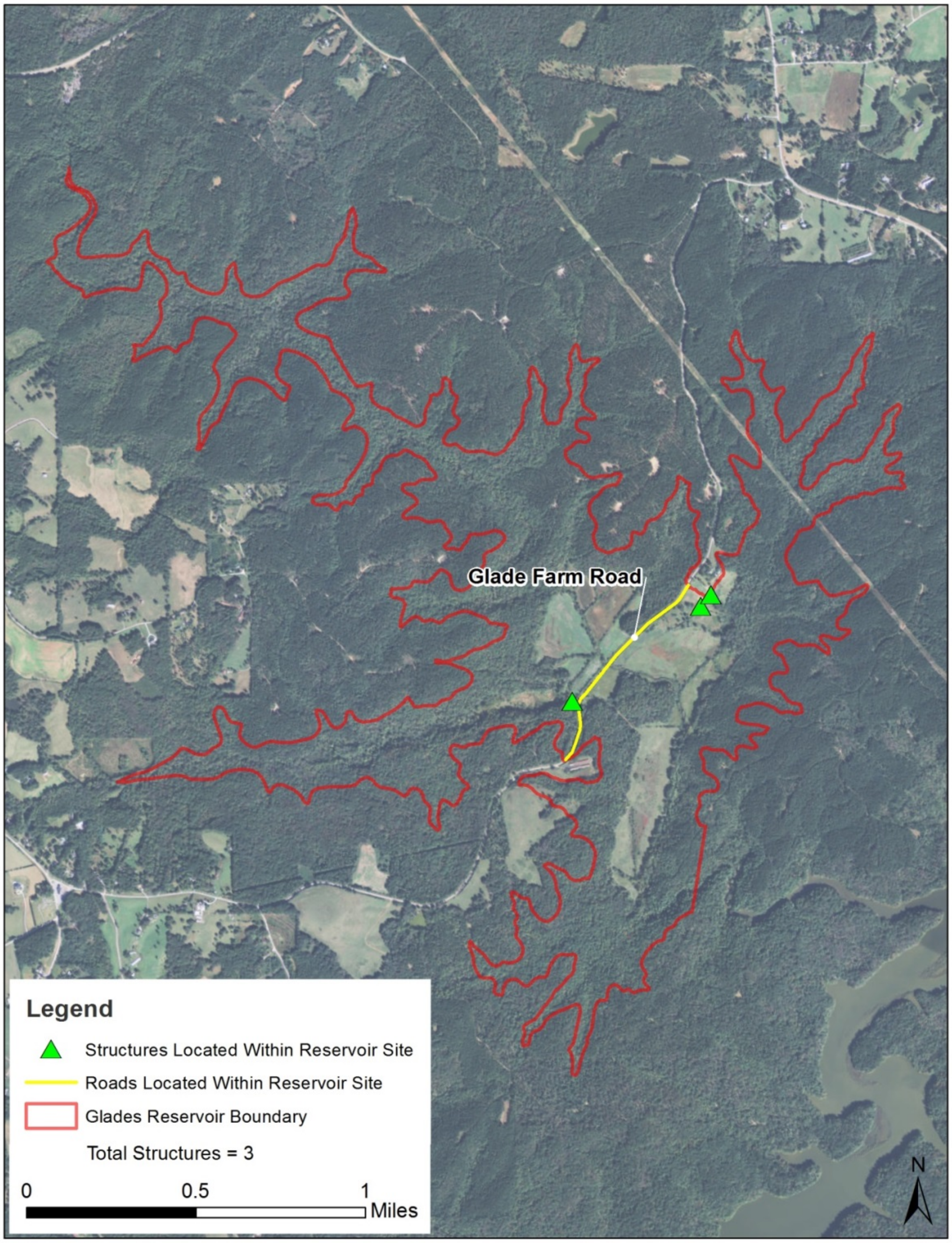
Reservoir Site

The land in the area of the reservoir site is characterized as rural residential. Glade Farm Road (**Figure 3.44**) connects unincorporated unnamed rural communities along Clarks Bridge Road (SR 284) to Lula Road (SR 52). Approximately 0.8 mile of Glade Farm Road is located within the reservoir site. The nature of the community can be inferred by the volumes of traffic that travel through it, such that lower traffic volumes indicate rural areas and higher traffic volumes indicate more populous areas. The annual average daily traffic (AADT) of Glade Farm Road is not available; however, 2013 AADT is available for the two streets that intersect with Glade Farm Road, i.e., Clarks Bridge Road and Lula Road. The AADT of Clarks Bridge Road (SR 284) near the intersection of Glade Farm Road is 3,370 vehicles per day (VPD), and the AADT of Lula Road (SR 52) near the intersection of Glade Farm Road is 3,850 VPD. Glade Farm Road is a lightly traveled road. No state routes or interstates are found within the reservoir footprint.

Hall Area Transit is a public transportation system that has served the City of Gainesville and Hall County since 1983. Hall Area Transit provides public transit with a fixed route bus service (Red Rabbit), ADA Complimentary Service (Mobility Plus), and Para-transit van services (Dial-A-Ride). These services are available to the public for a fee.

There are no schools, transportation hubs, shops, post offices, hospitals, or parks readily identified within the Glades Reservoir site (**Figure 3.44**). There are no emergency services facilities located within the reservoir footprint. There is one church located along Lula Road in the vicinity of the reservoir, but it is located outside the reservoir footprint, approximately 1,130 feet (0.2 mile) to the southwest of the nearest point of the reservoir. Glade Farm Road is a local road with three structures located within the reservoir site, including one commercial chicken house, one residential barn, and one residential outbuilding. Based on field data gathered in 2014, the commercial chicken house and residential outbuilding are no longer in use and in poor condition; the residential barn was described as in use and in fair condition. In addition to these total displacements, there are several additional structures located within the reservoir site that have fallen down and are in failing condition.

Figure 3.44 Glades Reservoir Communities and Roads



Reservoir Water Transmission System

Some alternatives include approximately 25 miles of transmission main from the reservoir, traveling south on Lula Road (SR 52) to Cornelia Highway (US 23) on the outskirts of Gainesville, to the Lakeside WTP located in Flowery Branch in Hall County, south of Gainesville. The balance of the mains would be located in rural areas. The mains will be located adjacent to existing right-of-way and would be buried underground and not anticipated to cause permanent disruption in communities. The booster pump station would be situated on approximately 1 acre of undeveloped lands adjacent to existing roadway right-of-way outside of residential neighborhoods.

The affected area of the new Glades WTP (for some alternatives) is undeveloped and does not consist of any roadways or communities.

3.8.2.2 White Creek Reservoir Alternatives

River Transmission System

The river water transmission main, pump station, and river intake to White Creek Reservoir will run adjacent to an existing right-of-way and will be buried underground. No communities are located in the immediate vicinity.

Reservoir Site

The White Creek Reservoir site is located within unincorporated White County. No incorporated communities or cities are located within the reservoir site. The land use within the White Creek Reservoir site is primarily rural farmland and rural residential. Numerous structures are found within this reservoir site, as seen in **Figure 3.45**.

There are no emergency services facilities located within the reservoir footprint. Based on a desktop survey and field-verified data, there are 41 total structures within the reservoir site, including numerous houses, residential barns, residential out buildings, one residential boat dock, commercial chicken houses, commercial stores, and a concrete foundation. The condition of these structures varies from poor to good condition and some are not in use.

Portions of the following 13 roads are located within the reservoir footprint:

- Webster Lake Road (AADT = 880 VPD)
- Stephens Drive (AADT not available)
- Unnamed Road (AADT not available)
- Orion Way (AADT not available)
- New Bridge Road (AADT = 740 VPD)
- Little Rock Road (AADT not available)
- Gospel Park Drive (AADT not available)
- Barrett Mill Road (AADT not available)
- Sam Craven Road (AADT = 1,820 VPD)
- Webb West Road (AADT not available)
- Evergreen Court (AADT not available)
- Crooked Pine Drive (AADT not available)
- Ashley Drive (AADT not available)

These local and county roads are lightly traveled roads. No state routes or interstates are found within the reservoir footprint. White County Senior Citizen Center offers in-county transit trips to the center, shopping, and appointments.

Reservoir Water Transmission System

Approximately 31 miles of transmission main, traveling south on Lula Road (SR 52) to Cornelia Highway (US 23) on the outskirts of Gainesville, would extend from the reservoir to the Lakeside WTP located in Flowery Branch. The balance of the mains would be located in unincorporated rural areas. The transmission mains from the White Creek Reservoir to the Lakeside WTP will run adjacent to existing roadway right-of-way and will be buried underground. The booster pump station would be situated on approximately 1 acre of undeveloped lands adjacent to existing roadway right-of-way outside of residential neighborhoods.

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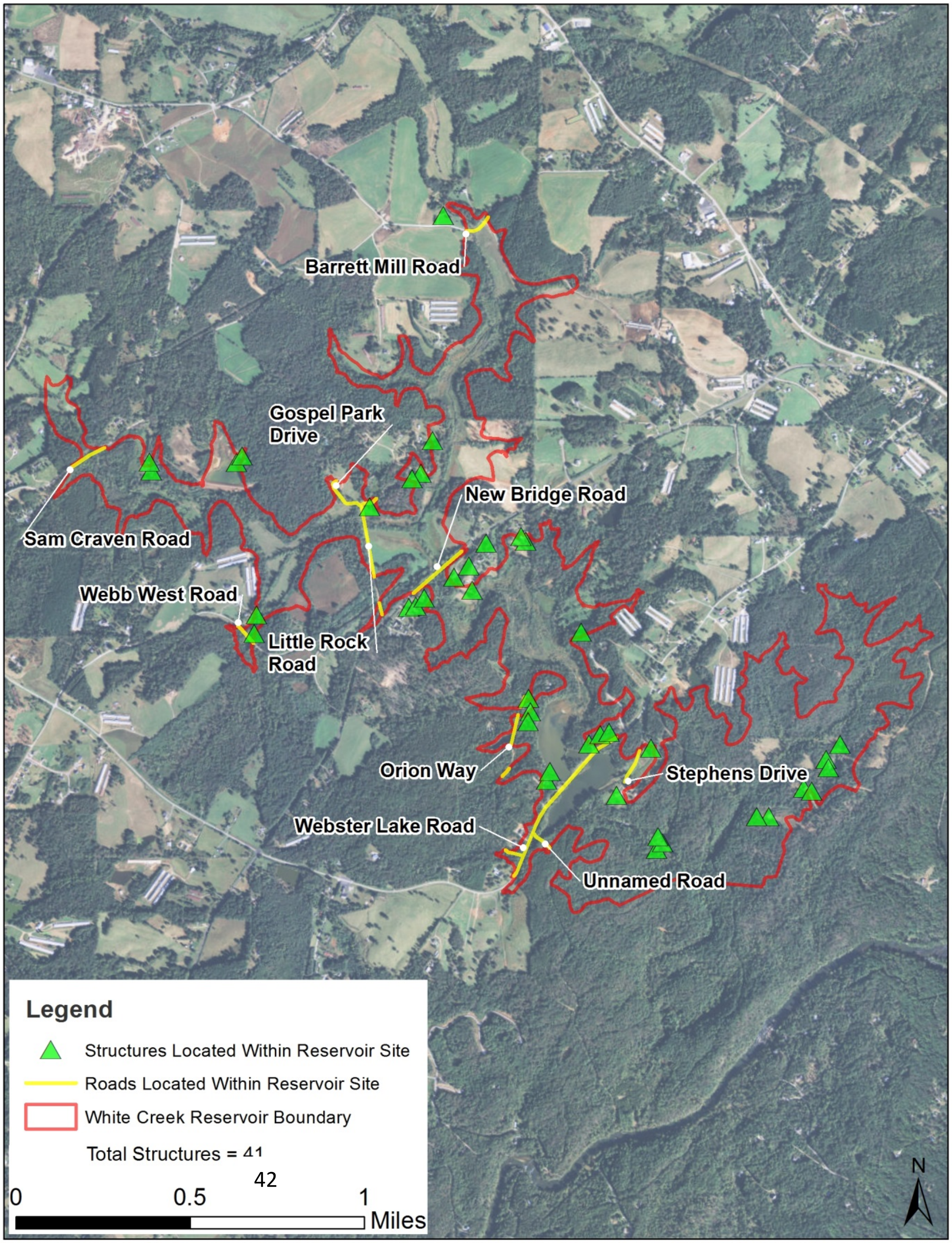
Figure 3.45 White Creek Reservoir Communities and Roads



3.8.3 Economic Trends

According to the Gainesville Hall County Comprehensive Plan, in 2003, there were approximately 80,964 jobs in Hall County (46,361 in Gainesville). It is anticipated that over the next 20 to 25 years, the number of jobs in the area will increase proportionally with the increase in population. If current trends continue, there is a potential that in 2025 approximately 80% of the city residents and 70% of county residents will work in the city or county. The following discussions focus on employment trends based on data available from the GDOL, Area Labor Profile, as of 2012 (updated 2014). The major employers for Hall, Habersham, and White counties are listed below in **Table 3.57**. Specifically, Hall County retains an economy based on recreation, healthcare, and the manufacturing/poultry industry. The GDOL provides unemployment data for Hall, Habersham, and White counties and the State of Georgia, with annual unemployment rates of 7.5%, 8.9%, 8.9%, and 9.0%, respectively. The unemployment rate for Hall County had been increasing until reaching a peak in 2009 and has been decreasing since 2012. Of the employed residents in Hall County, 69.0% work in the county; of the persons working in Hall County, 69.6% reside in the county. The unemployment rate trend in White County had been increasing until reaching a peak in 2010 and has been decreasing since 2012. Of the employed residents in White County, approximately 49.4% are employed in the county; 70% of those working in White County reside in the county. The unemployment rate in Habersham County had been increasing until reaching a peak in 2009 and has been decreasing since 2012. Of the employed residents in Habersham County, 67.6% work in the county; of the persons working in Habersham County, 69.6% reside in the county (GDOL Area Labor Profile).

Table 3.57 Top Ten Employers by County*

Hall County	White County	Habersham County
Fieldale Further Processing	Charles Black Construction Company, Inc.	ETCON Employment Solutions
Gainesville State College	Cobb Vantress, Inc.	Ethicon, Inc.
Kings Delight	Freudenberg-NOK General Partnership	Georgia Department of Corrections
Kubota Manufacturing of America Corporation	Friendship Health & Rehab, LLC	Ingles Market, Inc.
March-Jac Poultry	Gateway Health & Rehab, LLC	PCS
Northeast Georgia Medical Center, Inc.	Ingles Markets, Inc.	Piedmont College
Pilgrim's Pride Corporation	Jacky Jones Ford, Inc.	Scovill Fasteners
Victory Processing, LLC	The Troll Tavern	TC Baycor
Walmart	Truett-McConnell College	The Oaks at Scenic View, LLC
Wrigley Manufacturing Co, LLC	Walmart	Walmart

Notes:
*Not in order of ranking.
Source: Georgia Department of Labor, 2012

Table 3.58 shows the major categories of jobs and industries located in each of the counties. Hall County has built a diversity of industries with a range of employment options, which contribute to its economic stability as evidenced in **Table 3.58**, Existing Industry Establishments. Healthcare, professional services, construction, and retail trade account for almost half (i.e., 46%) of Hall County's industries. Hall County has plans for increasing manufacturing jobs, including a recent announcement of Kubota's expansion.

White County's economy is based on retail trade, accommodation and food services, and other services, which account for 42% of its industry. Habersham County's major industries include retail, health care, accommodation and food services, and other services, which total approximately half of the industry in the county.

Table 3.58 Existing Industry Establishments (2010)

Industry Type	County Data		
	Hall County	White County	Habersham County
Agriculture, Forestry, Fishing & Hunting	0.1%	0.5%	0.5%
Mining, Quarrying and Oil and Gas Extraction	0.1%	0.2%	0.1%
Utilities	0.1%	0.3%	0.9%
Construction	10.3%	13.4%	8.8%
Manufacturing	5.7%	4.5%	5.8%
Wholesale Trade	7.4%	3.2%	4.8%
Retail Trade	15.4%	21.1%	19.5%
Transportation and Warehousing	3.1%	2.2%	2.5%
Information	1.0%	1.7%	1.1%
Finance and Insurance	6.8%	4.5%	7.8%
Real Estate, Rental and Leasing	4.0%	3.4%	3.7%
Professional, Scientific and Technical Services	10.2%	7.4%	7.4%
Management of Companies and Enterprises	0.6%	0.3%	0.4%
Administration & Support, Waste Management and Remediation	5.7%	4.9%	4.4%
Educational Services	1.3%	1.0%	1.1%
Health Care and Social Assistance	11.0%	5.9%	9.9%
Arts, Entertainment, and Recreation	1.2%	2.0%	0.9%
Accommodation and Food Services	6.8%	13.4%	9.0%
Other Services (excluding Public Administration)	9.0%	10.2%	11.4%
Industries not classified	0.0%	0.0%	0.1%
Totals	100.0%	100.0%	100.0%

Source: 2010 Census Fact Finder

3.8.3.1 Glades Reservoir Alternatives

None of the county's major employers are located within the affected areas. Measurements of labor and economics are estimated using commercial establishments within the affected area. Glades Reservoir and its transmission systems are located within Hall County. There are several commercial structures located within the footprint of the reservoir site; however, these commercial structures were noted to be no longer in use. There are no commercial structures located within the footprint of the transmission main routes or booster pump station. There are several commercial structures that run adjacent to the transmission main routes.

3.8.3.2 White Creek Reservoir Alternatives

None of the county's major employers are located within the affected areas. White Creek Reservoir is located in White County; however, the associated transmission systems are located in White, Habersham, and Hall counties. There is one commercial structure located within the footprint of the reservoir site; however, during a field visit this structure was noted to be no longer in use. According to the White County Comprehensive Plan mapping, existing infrastructure density is relatively low in the vicinity of the White Creek Reservoir footprint. There are no commercial structures located within the transmission main routes or booster pump station. There are several commercial structures that run adjacent to the transmission main routes.

3.8.4 Recreation

This section summarizes the recreational activities, parklands, and recreationally important species within the affected environment. The primary affected recreational areas for the alternatives carried forward for further evaluation include the Chattahoochee River from the proposed pump station location to upstream of Lake Lanier, Lake Lanier, and Don Carter State Park. For more information on Lake Lanier, see also Lake Lanier recreation discussion in 3.3.1.1 ACF River Basin within the Water Resources section.

3.8.4.1 Recreation and Parklands

Fishing and boating is popular along the Chattahoochee River, where there are 6 public access points along the river within the vicinity of the Glades Reservoir and White Creek Reservoir including Don Carter State Park with two boat access locations, Lula Bridge, Belton Bridge, Mossy Creek, and Duncan Bridge. Boating includes motorboats, canoes, or kayaks (Figure 3.46). This area of the Chattahoochee River is also known as the Upper Chattahoochee River Water Trail, which was evaluated by the Upper Chattahoochee Riverkeeper in 2009. Access to the water trail may be individually based or also through a local outfitter. The Upper Chattahoochee River Water Trail is a 36.2-mile section of waterway with the goal of "creating recreational boating opportunities along the Chattahoochee while promoting land stewardship and conservation" (according to the Upper Chattahoochee River Water Trail website: www.chattahoochee.org/our-work/headwaters-regional-office/chattahoochee-river-water-trail/) . The river is described as having a range of class I to III rapids as well as flat lake waters to navigate. Recreationally important fishing species within the Chattahoochee River include shoal bass, striped bass, walleye, white bass, spotted bass (*Micropterus punctatus*), largemouth bass, and redbreast sunfish (*Lepomis auritus*) **Figure 3.47** summarizes the seven species of recreationally important game fish in Lake Lanier and the 6.7-mile stretch of upper Chattahoochee River (from the proposed Glades pump station to Flat Creek confluence) and their preferred habitats. Three species (striped bass, walleye, and white bass) migrate upriver during spring spawning run and requires deeper water during spawning season. **Table 3.59** summarizes the resident fish species grouped by habitat type.

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Figure 3.46 Chattahoochee River Acess Points

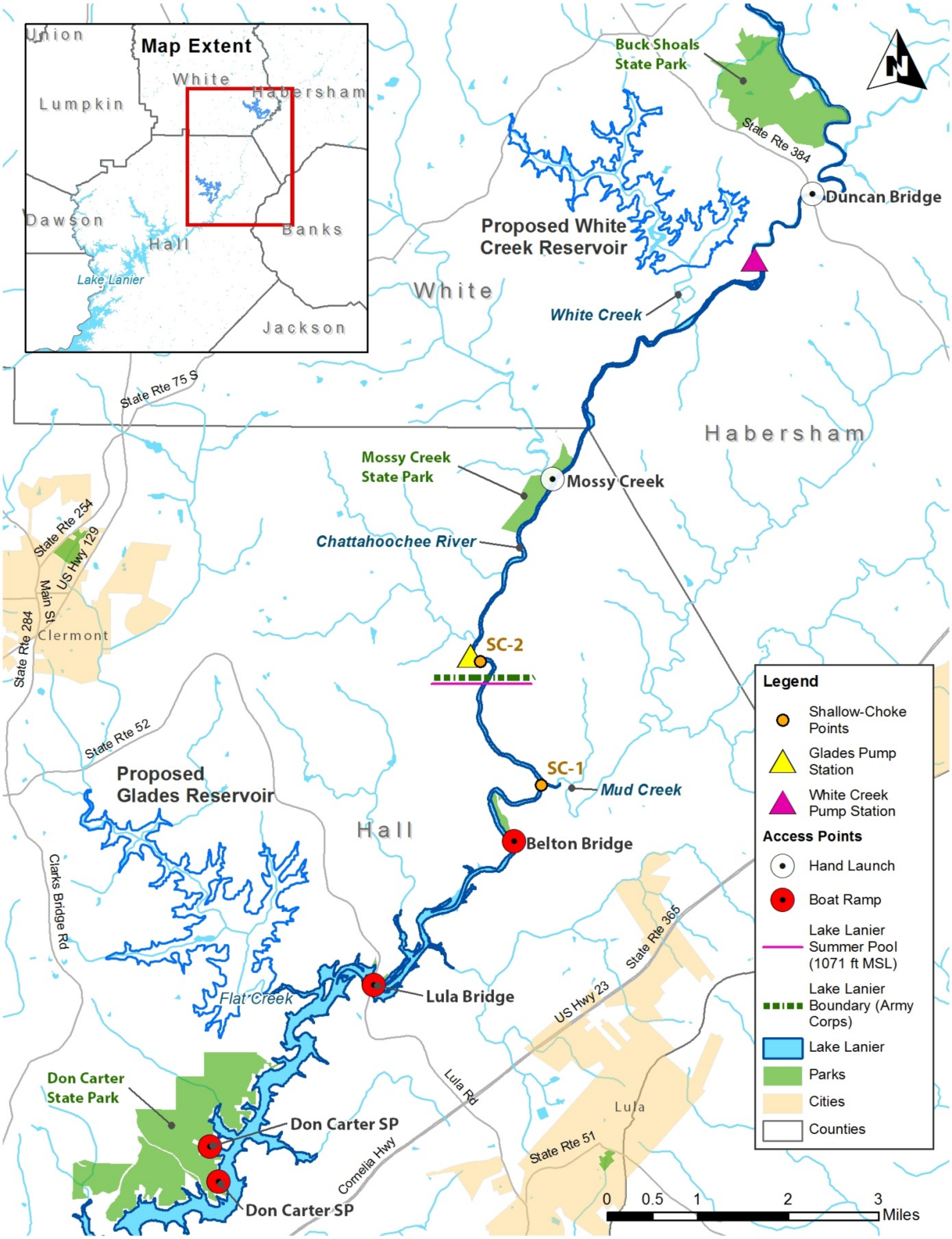


Figure 3.47 Lake Lanier Recreationally Important Game Fish

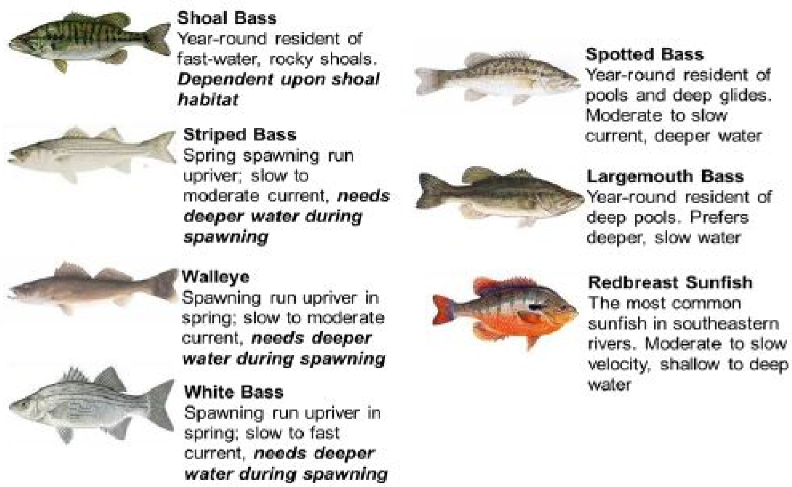


Table 3.59 Resident Fish Species Grouped by Habitat Type

Shallow/Fast (Shoals/Riffles)	Deep/Fast (Runs/Glides)	Deep/Slow (Pools)
Northern Hogsucker (S) *Hypentelium nigricans*	Spotted Bass (S) Micropterus punctulatus	Redbreast Sunfish (A, F, S) Lepomis auritus
Bluehead Chub (Y) *Nocomis leptocephalus*	Northern Hogsucker (F) Hypentelium nigricans	Spotted Bass (A) Micropterus punctulatus
Margined Madtom (A) *Noturus insignis*	Redbreast Sunfish (A, S) Lepomis auritus	Bluehead Chub (Y) Nocomis leptocephalus
Central Stoneroller (A) *Campostoma anomalum*	Silver Redhorse (Y) Moxostoma anisurum	
Generic Shallow Fast Guild	Bluehead Chub (Y) *Nocomis leptocephalus*	

Key to fish life stage abbreviations: A = Adult, F = Fry, S = Spawning, Y = Young

The entire Chattahoochee River is a popular and well-used recreation destination. Within Hall, White, and Habersham counties, the Chattahoochee River is regularly used for fishing and kayaking/canoeing/rafting. The river in these areas is accessible by small motorboats. Fish commonly spawn in the spring, which is a popular time of year for recreational fishing (**Appendix O**: Draft Technical Memorandum for Supplemental Impacts Analysis: Flow Impacts to Fish Community and Recreational Use Downstream of the Proposed Raw Water Intake in the Chattahoochee River, AECOM 2014). Types of fish found in the Upper Chattahoochee River include striped bass, walleye, crappie, catfish, and gar. There are six public access points within the Hall, Habersham, and White County reaches of the Chattahoochee River extending from the northern shores of Lake Lanier to just north of the Soque River for approximately 22 miles. These include Don Carter State Park (two access points), Lula Bridge, Belton Bridge, Mossy Creek, SR 384/Duncan Bridge, and the SR 115 Bridge. The segment of the Upper Chattahoochee River affected is not classified as a trout stream.

The most popular and predominant recreation area in Hall County is Lake Lanier, a 38,000-acre reservoir operated by the Corps, located about 50 miles northeast of Atlanta. Lake Lanier serves as a regional recreational destination and offers plentiful opportunities to picnic, hike, fish, boat, swim, camp, and many popular water sports such as rowing and water skiing. Hall County and surrounding properties offer a range of outdoor recreational activities, including several state parks, 23 Corps park sites on Lake Lanier, and 47 Hall County parks that include football, softball, baseball, and soccer fields. Lake Lanier includes many public and private launches. Several parks include tennis and basketball courts, picnic facilities, children's playgrounds, and camping facilities. Other recreation areas include four golf courses located in Hall County near Lake Lanier (Greater Hall County Chamber of Commerce website, 2014). There are recreational hunting areas throughout the county, including an area south of the Glades Reservoir site near the Chattahoochee River Park. Don Carter is Georgia's newest state park, as well as the first state park on 38,000-acre Lake Lanier. The park is situated on the north end of Lake Lanier south of the proposed Glades Reservoir site. It offers campgrounds, cabins, sand swimming beach, boat ramps, and a multi-use trail for hiking and biking through the hardwood forest.

The Chattahoochee River, popular with kayakers, canoers, and anglers, also flows through White and Habersham counties. Outdoor recreation areas and sites in White County are composed of "dispersed" recreation (hiking, camping, picnicking, fishing, hunting, and riding) and "developed" recreation (camping, picnicking, swimming, and boating) (White County website, 2014). Recreational opportunities within Habersham County include outdoor activities such as local area parks, hiking trails, horseback riding, zip line tours, golf courses, and access to aquatic activities such as fishing, fly fishing, boating, and swimming in local rivers and lakes (Habersham, 2014). Buck Shoals State Park is located approximately one mile from White Creek Reservoir upstream along the Chattahoochee River.

Glades Reservoir Alternatives

There are no recreational facilities located within the footprint of the river transmission main system, Glades Reservoir, the reservoir transmission system to the Lakeside WTP in Hall County, or the new Glades WTP. Although there are no state or national parks located within these affected areas, Lake Lanier's summer pool backs up to upstream of the confluence of Flat Creek and the Chattahoochee River (see **Figure 3.45** above). In addition, Don Carter State Park is located immediately downstream of the confluence of Flat Creek and Chattahoochee River just south of the proposed Glades Reservoir along the Chattahoochee River/Lake Lanier with camping, cabins, and recreation for swimmers, kayakers, bikers, and hikers.

Flat Creek is not a trout stream.

White Creek Reservoir Alternatives

There are no public recreational facilities located within the footprint of the river transmission system, White Creek Reservoir, or the reservoir transmission system that travels through White, Habersham, and Hall counties to the Lakeside WTP. However, Webster Lake, a private 20-acre lake along White Creek, would be inundated/incorporated into White Creek Reservoir. This private lake is used for fishing and small boating. There are no state or national parks located within these affected areas; however, Buck Shoals State Park is located approximately one mile north of the reservoir along the banks of the Chattahoochee River. White County has indicated future plans to expand county parklands into an area in the vicinity of SR 254, Lothridge Road, and Webster Road (White County Comprehensive Plan, Chapter 8, http://www.whitecountychamber.org/county-comprehensive-plan, accessed April 2, 2014 and May 7, 2015).

White Creek is not a trout stream.

3.8.4.2 Recreationally Important Species

Numerous wildlife species that provide human benefit occur in the vicinity of both reservoir sites. Both consumptive and non-consumptive uses of wildlife resources occur with the recreational species. Activities such as wildlife photography and bird watching are considered non-consumptive uses. Although these uses are difficult to quantify, they are considered in the evaluation of the wildlife resources in the area affected by the alternatives. Consumptive uses, such as fishing, hunting, and trapping, are more easily quantifiable and are often enjoyed in conjunction with non-consumptive uses. All wildlife in the affected area of the alternatives provides the potential for non-consumptive benefit, and many species of mammals and birds occurring in the affected area provide opportunity for consumptive use and represent a particularly important recreational and economic resource.

Lake Lanier in Hall County receives heavy fishing pressure due to the large regional population. Spotted bass, crappie, striped bass, and catfish are favorite targets of Lake Lanier anglers. Largemouth bass are relatively abundant in the upper areas of the reservoir and backwater sections of coves, where shallow water cover is prevalent. Lake Lanier supports an abundant and healthy spotted bass population. The population appears at a stable density and size structure (Georgia Wildlife, 2014). The striped bass population of Lake Lanier appears to be rebounding from a dip over the past few years. Walleye have been stocked into Lake Lanier since 2005 for the purpose of restoring the spring headwaters fishery following the demise of the white bass population (Georgia Wildlife, 2014). Stocked walleye grow well and reach a quality size in Lake Lanier.

The white-tailed deer (*Odocoileus virginianus*) is one of the most economically important big game mammals in Georgia. White-tailed deer bring in more than an estimated $800 million per year in hunting license fees, sporting equipment sales, food, and land leases. During the 2012–2013 hunting season, over 385,410 white-tailed deer were harvested in the states of Georgia (Georgia DNR, 2012–2013 Georgia Deer Harvest Summary). White-tailed deer are generalists and have the ability to thrive in a wide variety of habitats, including forests, woodlots, suburbs, golf courses, extensive?, agriculture, swamps, and coastal marshes. Optimum habitat for white-tailed deer consists of mixed age pine and hardwood forests interspersed with openings and agriculture. This habitat would provide the optimum combination of food, cover, and water (White-Tailed Deer Fact Sheet, April 2014).

The wild turkey (*Meleagris gallopavo*) population in Georgia is an estimated 300,000 birds with huntable numbers in all 159 counties of the state. During the 2013 hunting season, approximately 12,313 birds were harvested from the Piedmont Region and approximately 35,000 birds were harvested from the entire state (Georgia DNR, Turkey Harvest Summaries). Optimum habitat for wild turkeys consists of mature woodlands, with open understories and developed midstories, interspersed with grassy or weedy openings. Woodlands provide food and cover during the fall and winter, and openings are used during the spring and summer for brood rearing (Eastern Wild Turkey Fact Sheet, April 2014).

Other game species regularly hunted within the general region are the northern bobwhite quail (*Colinus virginianus*), mourning dove (*Zenaida macroura*), rabbits, gray squirrels (*S. carolinensis*), fox squirrels (*Sciurus niger*), and numerous species of migratory waterfowl. Northern bobwhite quail are an early succession edge species that need an interspersion of cover that is predominated by annual and perennial weeds and legumes, clumped native warm season grasses, and a mosaic distribution of briar and shrub thickets. The mourning dove is hunted by more Georgians than any game species in the state, except deer, and the dove harvest is the highest of any species in the state. It is found throughout Georgia and has adapted to many different habitat types that provide their basic requirements of food, water, nesting cover, roosting cover, and resting sites (Georgia DNR, 2002).

Glades Reservoir Alternatives

Recreationally important species may be located in undeveloped areas within the footprint of the river transmission system, Glades Reservoir, and the transmission system to Lakeside WTP in Hall County. The terrestrial recreational species that may occur within these areas are mobile in nature. Glade Lake, an 8.3-acre lake, which would be absorbed as part of the Glades Reservoir, is located on private property. Flat Creek is not identified as a trout stream.

White Creek Reservoir Alternatives

Recreationally important species may be located in undeveloped areas within the footprint of the river transmission system, White Creek Reservoir, and the transmission system to the Lakeside WTP that crosses White, Habersham, and Hall counties. Webster Lake, which would be absorbed as part of the White Creek Reservoir, currently serves as private fishing for these species: muskie, bream, redear sunfish, bluegill, crappie, largemouth bass, and perch. White Creek is not identified as a trout stream according to the Georgia DNR mapping (3/19/04).

3.9 Visual and Aesthetic Resources

Title 23 of the Unites States Code, Section 109(h), requires aesthetic values to be considered during project development. The CEQ regulations for implementing NEPA (Section 1508.8 – Effects), states that aesthetic effects should be considered. Visual and aesthetic environments are the natural and cultural features of the landscape that can be seen and that contribute to the public’s appreciation and enjoyment of the environment. The visual environment encompasses elements from both the built and natural environments. These can include solitary built and natural landmarks (such as buildings and trees, bodies of water, and corridors) or entire landscapes. Visual resources are evaluated in terms of “visual dominance” and “visual sensitivity.”

Viewshed

The geographical area that is visible from a location. It includes all surrounding points that are in line-of-sight with that location and excludes points that are beyond the horizon or obstructed by terrain and other features (e.g., buildings, trees).

This section describes existing scenic quality and landscape characteristics for the areas that may be potentially affected for each alternative. Existing landscape characteristics refer to the scenic attributes (landform, water, cultural elements, and vegetation) combined with the cultural values that people assign to landscapes. Landscape character descriptions define a “sense of place,” or scenic expression, as well as provide a written baseline condition from which to monitor change in scenic resources in the future.

All project alternatives are located in the Piedmont physiographic region in northeast Georgia, where undeveloped rural pasturelands and rolling terrain are commonly found. These areas are rural in nature and lack of centralized community resources that could serve as points from which to view the aesthetics of the area. None of these alternatives are visible from Lake Lanier. The primary manner in which aesthetics and visual impacts of project implementation could occur for the greatest number of people would be views from public roads. In general, as the topographic elevations change, there are greater or lesser visual fields available to be seen.

3.9.1 Glades Reservoir Alternatives

3.9.1.1 River Transmission System

The river transmission system for the proposed Glades Reservoir is located entirely in Hall County. The raw water intake and transmission mains are located in a rural setting comprised of forested land and agricultural areas, including wooded, rural residential lands, open pasturelands, and rural county and state routes. No unique aesthetic vegetation areas or geological formations are located in the vicinity of the river transmission system. Potential aesthetic resources include agricultural pastureland and the riparian areas associated with the Chattahoochee River.

3.9.1.2 Reservoir Site

The existing visual resources in the vicinity of the Glades Reservoir site include predominantly forested land with smaller areas of agricultural/pastureland and a linear utility right-of-way associated with an electrical transmission line. The periphery of the proposed Glades Reservoir is associated with forested hilltop ridges with no residential or commercial development. One rural county road, Glade Farm Road, traverses the area associated with the proposed Glades Reservoir site, and all other roadways in the vicinity are located outside the periphery of the reservoir site. A small lake is currently located within the reservoir footprint. Floodplain terraces of Flat Creek, fast running shoals of a stream, multiple species of trees, and understory vegetation dominates the landscape. The majority of this reservoir site is located on one large parcel with few built structures. No unique aesthetic vegetation areas or geological formations are located in the vicinity of the Glades Reservoir site. From Glade Farm Road and the Glade Farm house, potential aesthetic resources that can be seen include a forested ridge line in the far distance and pastureland.

3.9.1.3 Reservoir Water Transmission System

Some of the alternatives include a pump station at the reservoir, a transmission main to convey raw water from the reservoir to the existing Lakeside WTP, and a booster pump station midway along the transmission main. The northern portion of the proposed transmission main (approximately 5% of the transmission main length) is located in rural areas comprised of forested land, agriculture, and areas of single-family residential development where no unique aesthetic vegetation areas or geological formations are found. The majority of the transmission main (approximately 89%) is located adjacent to I-985/US 23/Cornelia Highway, extending into the Gainesville and Oakwood city limits and terminating at Lakeside WTP, and will travel in a utility right-of-way (approximately 6% of the length of the transmission main). The I-985/US 23/Cornelia Highway is designated as a limited access rural arterial roadway with a depressed and grassed center median. Potential aesthetic resources include several agricultural areas. The area outside the city limits, however, is predominantly comprised of forested land interspersed with areas of commercial development, and the area inside the city limits consists of more urbanized aesthetic development, especially around interchanges.

3.9.2 White Creek Reservoir Alternatives

3.9.2.1 River Water Transmission System

Potential aesthetic resources include the forested hilltop ridgeline, agricultural pastureland associated with views from New Bridge Road, and the agricultural pastureland and lake associated with the Webster Lake Road viewshed. The river intake and transmission main are located in a rural setting comprised of forested and agricultural lands and single-family residential development areas. No unique aesthetic vegetation areas or geological formations are located in the vicinity of the river water transmission system. Potential aesthetic resources include agricultural pastureland and the riparian areas associated with the Chattahoochee River.

3.9.2.2 Reservoir Site

The existing visual resources in the vicinity of the White Creek Reservoir site include predominantly forested land with varying terrains, Webster Lake (bisected by Webster Lake Road), and areas of single-family residential development interspersed with agricultural areas comprised of pastureland and poultry houses. The periphery of the White Creek Reservoir site is associated with forested hilltop ridges with areas of single-family residential development and agricultural pasturelands. Several roads, including New Bridge Road and Webster Lake Road, traverse the affected area associated with White Creek Reservoir. There is no unique aesthetic vegetation located in the vicinity of the White Creek Reservoir site.

3.9.2.3 Reservoir Water Transmission Systems

Some of the alternatives include a raw water pump station at the reservoir, a transmission main to convey raw water from the reservoir to the existing Lakeside WTP, and a booster pump station midway along the transmission route. The route of the transmission main travels through White, Habersham, and Hall counties. The northern portion of the reservoir transmission main (approximately 6% of the total length) is located in an existing utility right-of-way comprised of residential development and forested land. A small portion of the reservoir water transmission main will cross the Chattahoochee River (approximately 1%). The balance of the reservoir transmission main (approximately 93%) is located adjacent to Crow Bridge Road, Pea Ridge Road, Belton Bridge Road, and along I-985/US 23/Cornelia

Highway. Crow Bridge Road, Pea Ridge Road and Belton Bridge Road travel through rural areas comprised of forested land, agriculture, and areas of single-family residential development where no unique aesthetic vegetation areas or geological formations are found. Potential aesthetic resources for I-985/US 23/Cornelia Highway include several agricultural areas; however, this area is predominantly comprised of forested land interspersed with areas of commercial development in urbanized areas of the main corridor.

3.10 Air Quality

This section summarizes the following for the affected environment:

- Ambient air quality, current standards, and conformity (attainment or non-attainment) status with these standards
- Greenhouse gases (GHG) and existing inventory of GHG emission facilities in the affected counties

3.10.1 Ambient Air Quality

The purpose of the Clean Air Act (CAA) of 1977 (42 U.S.C. §7401-7661) is to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacities of its population." The CAA establishes the federal standards for various pollutants from both stationary and mobile sources and provides for the regulation of polluting emissions via state implementation plans. Under the CAA, the EPA sets National Ambient Air Quality Standards (NAAQS) for seven key air pollutants to protect public health and the environment, with an adequate margin of safety. The Clean Air Act Amendments (CAAA) of 1990 establishes specific milestones toward attaining the NAAQS, depending on the severity of the air pollution problem in the region.

The NAAQS for the seven pollutants are listed in **Table 3.60**. NAAQS exist for carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter for both 10 and 2.5 microns and less (PM_{10} and $PM_{2.5}$), and lead (Pb). Particulate matter consists of tiny particles that are emitted by vehicle engines (especially the diesel engines of trucks), brake pads, tires, and other moving parts of motor vehicles. These particles contribute to smog and haze, and are dangerous to human health, especially to people with respiratory conditions. The EPA provides health criteria for particles smaller than 10 microns (about one-seventh the width of a human hair) and for particles smaller than 2.5 microns. Air quality in Georgia is defined with respect to conformity with the NAAQS. The EPA classifies geographic regions as having air quality better than or equal to (i.e., attainment) or worse than (i.e., non-attainment) these standards.

The Glades Reservoir site and both river and reservoir transmission systems associated with Glades Reservoir are located entirely in Hall County. Hall County is located in the Gainesville-Hall Metropolitan Planning Organization (GHMPO) and is incorporated into the Atlanta Regional Commission (ARC) Metropolitan Planning Organization (MPO) air quality assessment area for $PM_{2.5}$. The ARC MPO area currently does not meet EPA NAAQS for $PM_{2.5}$ (considered non-attainment area for $PM_{2.5}$). Hall County was originally part of a geographic area that was designated as non-attainment for ozone; however, as of 2013 Hall County was removed from ozone non-attainment boundary, and was designated as part of a 20-County area, 8-hour ozone *maintenance* area. Hall County is designated as part of a 22-county non-attainment area for particulate matter fewer than 2.5 microns in diameter ($PM_{2.5}$) (http://www.epa.gov/airquality/greenbook/ancl.html). Hall County is *outside* the non-attainment areas for CO, PM-10, SO2, NO2, and Pb.

Table 3.60 National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary Standards	Averaging Times	Secondary Standards
Carbon Monoxide (CO)	9 ppm (10 mg/m³)	8-hour[1]	None
	35 ppm (40 mg/m³)	1-hour[1]	None
Lead (Pb)	0.15 µg/m³	Quarterly Average	Same as Primary
Nitrogen Dioxide (NO2)	0.053 ppm (100 µg/m³)	Annual (Arithmetic Mean)	Same as Primary
Particulate Matter (PM_{10})	150 µg/m³	24-hour[1]	Same as Primary
Particulate Matter ($PM_{2.5}$)	15.0 µg/m³	Annual[2] (Arithmetic Mean)	Same as Primary
	35 µg/m³	24-hour[3]	Same as Primary
Ozone (O3)	0.075 ppm	8-hour[4]	Same as Primary
	0.08 ppm	8-hour[5]	Same as Primary
Sulfur Dioxide (SO2)	0.03 ppm	Annual (Arithmetic Mean)	-------
	0.75 ppm	24-hour[1]	-------
	-------	3-hour[1]	0.5 ppm (1300 µg/m³)

Notes:
µg/m³ = micrograms per cubic meter
mg/m³ = milligrams per cubic meter
ppm = parts per million
[1] Not to be exceeded more than once per year.
[2] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m³.
[3] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m³.
[4] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average O_3 concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
[5] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average O_3 concentrations measure at each monitor within an area over each year must not exceed 0.075 ppm.
Source: EPA NAAQS website

The White Creek Reservoir site and the river water transmission system for White Creek Reservoir are located in White County. White County is not within the ARC jurisdictional area and currently meets all of the EPA NAAQS standards. Part of the transmission main that will convey raw water from White Creek Reservoir to the existing Lakeside WTP is located in White and Habersham counties, and the majority of the transmission main is located in Hall County. Habersham and White counties are not located within the jurisdictional area of the ARC and meet all of the EPA NAAQS standards.

3.10.2 Greenhouse Gases (Climate Change)

A greenhouse gas (GHG) is any gas that absorbs infrared radiation in the atmosphere contributing to the greenhouse effect and rising atmospheric temperatures. According to the EPA, there are four types of GHGs: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and fluorinated gases (e.g., hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, etc.). Some GHGs are naturally occurring in the atmosphere and human activities increase their atmospheric presence, while others are purely the result of human activities. Carbon dioxide occurs naturally in the atmosphere, but also enters the atmosphere through burning fossil fuels. Carbon dioxide is removed from the atmosphere (also known as sequestered) when it is absorbed by plants. Methane occurs naturally in the atmosphere, but is also emitted into the atmosphere during the production and transport of fossil fuels, the decaying of organic wastes, and as a result of livestock and other agricultural practices. Nitrous oxide occurs naturally in the atmosphere, but is also emitted during the combustion of fossil fuels and solid waste, and during agricultural and industrial activities. Fluorinated gases are synthetic and only come from human-related activities. Fluorinated gases are emitted through industrial processes such as aluminum and magnesium manufacturing and electrical transmission and distribution. Fluorinated gases have long atmospheric lifetimes and are removed from the atmosphere when they are destroyed by sunlight in the far upper atmosphere. Fluorinated gases are considered the most potent and longest lasting type of GHG emitted by human activities.

According to the EPA, one acre of average U.S. forest sequesters 1.22 metric tons of CO2 per year. A buildup of GHG in the atmosphere is a contributing factor to the warming trend. According to the National Aeronautics and Space Administration (NASA), the Earth's average surface temperature has increased almost 1.5°F during the 20th century. A majority of the warming has occurred since 1975, at a rate roughly 0.3 to 0.4°F per decade.

The GHG emissions and removals are inventoried in the United States annually by the EPA in the "Inventory of Greenhouse Gas Emissions and Sinks." The report tracks total annual emissions and removals according to source, economic sector, and GHG, dating back to 1990. The data available via the EPA goes through 2012. While data indicates that levels of carbon dioxide were on a declining trend between 2010 and 2012, CO2 levels overall between 1990 and 2012 increased by 5.4% with CO2 accounting for the largest percentage of GHG in 2012 at 82% (5,383 metric tons). Methane has declined 10.8% between 1990 and 2012, and accounted for 9% (567 metric tons) of the total GHGs emitted in 2012. Nitrous oxide emissions between 1990 and 2012 have increased by 2.9%, and in 2012, accounted for 6% (410 metric tons) of the total emissions. Levels of fluorinated gases emitted between 1990 and 2012 increased 83.0%, and accounted for 3% (165 metric tons) of total emissions in 2012.

The EPA also publishes the Facility Level Information on Greenhouse Gases Tool (FLIGHT). According to FLIGHT:

- Hall County has three large facilities that reported GHG emissions for 2013. In 2013, Cargill (located approximately 9 miles southwest of the Glades Reservoir site) reported 85,616 metric tons CO2e (CO2, CH4, and N2O); the Hall County Allen Creek Landfill (located approximately 10 miles south of the Glades Reservoir site) reported 21,072 metric tons CO2e (CH4); and the Hall County Candler Road Municipal Solid Waste Landfill (MSWLF) (located approximately 11 miles southwest of the Glades Reservoir site) reported 53,033 metric tons CO2e (CH4).
- White County had no listings in the EPA FLIGHT database.
- Habersham County had one large facility that reported GHG emissions for 2013 in the FLIGHT database. The Habersham County SR 13 MSWLF (located approximately 10 miles east of the White Creek Reservoir site) reported 35,854 metric tons CO2e (CH4).

The GHG and climate change consequences of the alternatives carried forward for further analysis will be discussed in detail in Chapter 4 Environmental Consequences. The changes and consequences will be estimated based on the change in land use.

3.11 Noise

This section provide a background on noise and sound level definitions, an overview of regulations, local ordinances, and existing noise conditions for the affected area.

3.11.1 Definitions and Common Sound Levels

Noise is defined as an undesirable sound that interferes with communication, is intense enough to damage hearing, or is otherwise intrusive. Noise is characterized by many variables including frequency, duration, and intensity. Sound pressure level (SPL) is described in decibels (dB) and is used to quantify sound intensity.

The Noise Control Act of 1972 (42 U.S.C. §4901) establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare, and authorizes the establishment of federal noise emission standards. The EPA has identified a Day-Night Average Sound Level (Ldn) of 55 A-weighted decibels (dBAs) as the maximum sound level which would not adversely affect public health and welfare by interfering with speech or other activities in outdoor areas.

The EPA published Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (EPA, 1974). This publication evaluates environmental noise impacts with respect to health and safety. The document provides information to help agencies develop noise standards and regulations. In June 1980, a Federal Interagency Committee on Urban Noise published guidelines (FICON, 1980) relating Ldn to compatible (and incompatible) land uses. In general, residential land uses are not compatible with an outdoor Ldn above 65 dBA. The Aviation Safety and Noise Abatement Act of 1979 established provisions for submitting noise exposure maps and noise compatibility programs to reduce existing non-compatible lands uses and prevent introducing additional non-compatible uses.

Sound Descriptors

The EPA has adopted the following four descriptors for sound, all normally measured as dBA, which take into account how sound is propagated and heard (EPA, 1974):

- **A-weighted Sound Level (L_A)**
  Corresponds to the way the human ear perceives the magnitude of sounds at different frequencies.
- **A-weighted Sound Exposure Level (SEL)**
  This is the intensity of sound measured over a period for time, usually of one-second duration. The SEL allows direct comparison of sounds with different magnitudes and duration.
- **Equivalent Sound Level (L_{eq})** A summation of the individual sound energies over a given period of time, usually one hour, and is expressed in dBA.
- **Day-Night Average Sound Level (Ldn)**
  This is the L_{eq} for a full 24-hour period taking into account the increased perception of sound at night by adding 10 dBA to the period between 10 p.m. and 7 a.m.

Human response to sound varies depending on the sound type and characteristics, distance between the sound source and the receptor, receptor sensitivity, and time of day. Also, the human ear responds differently to different frequencies. Sound can interfere with communication, awaken people from sleep, damage the ear, or affect wildlife. Sound is often generated by activities essential to a community's quality of life such as construction or vehicular traffic.

Noise-sensitive receptors are locations or areas where excessive noise may disrupt normal activity, cause annoyance and business loss, or disturb sensitive ecological habitats. Land uses such as residential, religious, educational, recreational, and medical facilities are more sensitive to increased noise levels than are commercial and industrial land uses.

Background noise is always present and includes noise caused by wind moving through the trees, water running in the river, streams, and canals, bird calls, and barking dogs. Sound levels produced in urban areas include typical urban residential noise from outdoor family activities, cars traveling to and from work, and recreational activities, and typical agricultural and commercial activities such as sounds generated by delivery trucks, agricultural equipment operation, and warehouse operations.

Table 3.61 includes a list of common sound sources and levels. **Table 3.62** presents examples of typical sounds levels for construction equipment. Some will be used for the construction of the alternatives carried forward for further evaluation.

Table 3.61 Common Sounds Sources and Levels

Outdoor	Sound Level (dBA)	Indoor
Snowmobile	100	Subway train
Tractor	90	Garbage disposal
Noisy restaurant	85	Blender
Downtown (large city)	80	Ringing telephone
Freeway traffic	70	TV audio
Normal conversation	60	Sewing machine
Rainfall	50	Refrigerator
Quiet residential area	40	Library

Notes:
dBA = A-weighted decibels
Source: Harris, 1998

Table 3.62 General Construction Equipment Sound Levels

Equipment	Typical Sound Level (dBA) 50 feet from Source
Air Compressor	81
Backhoe	80
Ballast Tamper	83
Compactor	82
Concrete Mixer	85
Concrete Pump	82
Concrete Vibrator	76
Crane Mobile	83
Dozer	85
Generator	81
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	85
Paver	89
Pneumatic Tool	85
Pump	76
Roller	74
Saw	76
Scraper	89
Shovel (e.g., steam)	82
Truck	88

Notes:
dBA = A-weighted decibels
Source: Federal Highway Administration, 2006

3.11.2 Local Noise Ordinances and Existing Noise Conditions

Georgia does not regulate noise at the state level. Local ordinances have been established instead to regulate noise. Hall County and Habersham County have noise ordinances that restrict loud, unnecessary, or unusual sounds that unreasonably annoy or disturb the comfort and peace of county residents (Hall County Code of Ordinances, 2014; Habersham County Code of Ordinances, 2007). White County does not maintain a noise ordinance in its Code of Ordinances (White County Code of Ordinances, 2013). Existing noise levels were not measured in the affected areas for the Proposed Project and alternatives; background levels are estimated to be typical for the land types and uses. Additionally, in order to evaluate the noise levels present throughout the day and night, the Ldn, which is the Leq for a full 24-hour period, takes into account the increased perception of sound at night by adding 10 dBA to the period between 10 p.m. and 7 a.m.

3.11.2.1 Glades Reservoir Alternatives

The river transmission system for Glades Reservoir is located in Hall County in predominantly rural areas with residences and several commercial farming operations scattered throughout the area. The Ldn is approximately 50 to 60 dBA in these areas.

The Glades Reservoir footprint is located in Hall County in a generally undeveloped and forested area (forestland use accounts for approximately 85% of the proposed reservoir footprint). While background noise levels for rural areas are not well documented, the use of 50 dBA for daytime noise in quiet urban areas has been described (FAA, 2001). Therefore, this noise level for quiet urban areas will be applied to background noise levels for rural areas. In rural areas, the Ldn is approximately 50 to 60 dBA.

The reservoir transmission system is located in Hall County. The northern portion of the reservoir water transmission main (approximately 5% of the total length) is located in rural areas, where the Ldn is approximately 50 to 60 dBA. The majority of the transmission main (approximately 90%) is located adjacent to US 23/ SR 365/Cornelia Highway. While background noise levels for this roadway have not been determined, the use of a noisy urban area during daytime is a reasonable surrogate for this limited access roadway where the Ldn would be 80 to 90 dBA. The transmission main will terminate at the Lakeside WTP by traveling through an existing utility right-of-way (approximately 6%).

3.11.2.2 White Creek Reservoir Alternatives

The river water transmission system to the proposed White Creek Reservoir is located in White County in predominantly rural areas. The estimated Ldn is approximately 50 to 60 dBA for this rural area.

The White Creek Reservoir site is located in a predominantly forested area (forestland use accounts for approximately 76% of the reservoir footprint) with approximately 7% of the area in high density urban land use. Quiet urban areas have noise levels at approximately 50 dBA during the daytime, and noisy urban areas are approximately 80 dBA during the daytime. The Ldn in the vicinity of the undeveloped, forested areas is approximately 50 to 60 dBA, and the Ldn in the high density urban areas likely does not exceed 80 dBA.

The reservoir water transmission system is located in White, Habersham, and Hall counties. The portion of the transmission main (approximately 20%) located in rural areas has an Ldn of approximately 50 to 60 dBA, while the portion of the transmission main located adjacent to US 23/SR 365/Cornelia Highway (approximately 80%) has an Ldn of approximately 80 to 90 dBA. A residential neighborhood is adjacent to a utility right-of-way through which the transmission main will travel. The Ldn for residential areas is approximately 70 to 80 dBA.

3.12 Cultural Resources

The purpose of this section is to describe the regulatory setting and cultural resources associated with the affected environment for the Proposed Project and alternatives. This section presents a synopsis of all documented cultural resources within the Area of Potential Effect (APE) for this undertaking, presented in relation to the current alternatives under consideration. When a preferred alternative has been identified, more detailed and intensive cultural resources investigations may be undertaken in consultation with the State Historic Preservation Office (SHPO) of the Georgia Historic Preservation Division (HPD). For the purposes of this document, that office will be referred to simply as SHPO.

Cultural resources include prehistoric archaeological sites, historic-era archaeological sites, traditional cultural properties, and historic properties, as described below:

- Historic properties – buildings, structures, landscapes, districts, and linear features that are 50 years or older and meet specific criteria defined in the National Historic Preservation Act (NHPA).
- Prehistoric archaeological sites – places where Native Americans lived or carried out activities during the prehistoric period; may contain artifacts, cultural features, subsistence remains, and human burials.
- Historic archaeological sites – can include the physical remains of any human activity that took place after the arrival of Europeans to North America.

The remains of domestic, industrial, or commercial activities may be discovered within the APE. Domestic sites would include house and house lots; industrial sites may include such properties as mills, mines, and warehouses. Farmsteads are another unique type of historic archaeological resource recognized in Georgia.

3.12.1 Regulatory Context

Cultural resource studies have been prepared in accordance with the following:

- Section 106 of the National Historic Preservation Act of 1966, as amended
- Procedures for the Protection of Historic and Cultural Properties in 36 CFR 800, as amended
- 23 CFR 771, as amended
- Guidance published by the Advisory Council on Historic Preservation (ACHP)
- Sections 1(3) and 2(b) of Executive Order 11593 *Protection and Enhancement of the Cultural Environment*
- National Environmental Policy Act of 1969

Section 106 requires that the effect(s) of any federally assisted undertaking on historically significant buildings, structures, objects, or sites be taken into account during the project planning process. Significant sites are those listed in or eligible for listing in the National Register of Historic Places (NRHP).

To be considered eligible for listing in the NRHP, historic properties must meet at least one of the four NRHP criteria and retain sufficient historic integrity to convey their significance. The NRHP uses the following four Criteria for Evaluation (36 CFR §60.4) to evaluate significance:

- Criterion A: [properties] that are associated with events that have made a significant contribution to the broad patterns of our history; and/or
- Criterion B: [properties] that are associated with the lives of persons significant to our past; and/or
- Criterion C: [properties] that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master; or that possess high artistic values; or that represent a significant and distinguishable entity whose components may lack individual distinction; and/or
- Criterion D: [properties] that have yielded, or may be likely to yield, information important in prehistory or history.

3.12.2 Area of Potential Effects

Four APEs are included in this analysis and are described below. The APE describes the geographic area evaluated for cultural resources for the Proposed Project (see detailed definition in the text box to the right). For simplicity, an 'APE' will generically describe one of the following APEs evaluated for this EIS:

- Glades Reservoir APE – consists of geographic area/viewshed in vicinity of reservoir, including reservoir at flood pool elevation, pump station, transmission main from the river to the reservoir, roadways, and new WTP.
- White Creek Reservoir APE – consists of geographic area/viewshed in vicinity of reservoir, including reservoir at flood pool elevation, pump station, transmission main from the river to the reservoir, and roadways.
- Glades and White Creek Transmission System APE – consists of geographic area/viewshed of transmission main from the reservoir to the Lakeside WTP, including the booster pump.

3.12.2.1 Glades Reservoir Alternatives

Cultural resources surveys that have been conducted in the area of Glades Reservoir are included in **Table 3.63**. In 2002, an 850-acre archaeological and historic building survey was conducted for Glades Reservoir on Flat Creek at Glade Farm in Hall County, Georgia (Price, 2002), which was included as part of the 404

Area of Potential Effects

The Area of Potential Effects (APE) is defined in the regulations implementing the Section 106 review process as "The geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking." [36 CFR Part 800.16(d)]. Determining the APE is one of the most critical steps in the 106 process.

The terminology of APE will only be used in the evaluation of cultural resources in this EIS. For all other resources, the "affected area" or "affected environment" is used throughout.

Permit Application Package. The results of that cultural resources survey are incorporated below. In response to that report, the SHPO requested additional information on the potentially NRHP-eligible structures within an area designated as Property E and additional documentation for Property A (**Appendix T**). To address the SHPO's requests for information, a field reconnaissance survey of Property E in 2014 was conducted, (**Appendix T**), which recorded the current condition of the buildings on Property E, and a Georgia Archaeological Site Form was drafted for this property. The Glade Farm boundary justification was developed to support the NRHP-recommended boundary for the property. Lastly, Property Information Forms (PIFs) were developed in 2014 for two newly identified properties. The results of these additional studies are summarized in the sections below and in detail in **Appendix T**.

Table 3.63 Glades Reservoir: Summary of Cultural Resource Investigations

Author Year	Report Title	Area	Findings/Recommendations
Price 2002	Cultural Resources Survey of the Proposed 850-Acre Glades Reservoir on Flat Creek, Hall County, Georgia	850 acres	Glade Farm House recommended eligible for NRHP. 18 archaeological sites & 14 isolated finds. Phase II testing is recommended for sites 9HL462 and 9HL478. Five areas in the floodplain of Flat Creek are recommended for additional trenching/stripping.
AECOM 2014	Historic Structures & Landscape Sight Lines	Reservoir Boundary in relation to Glade Farm and Property E	Structures that were extant in 2002 were observed to be in ruins in 2014. The Corps recommends that structures located within Property E are not eligible for the NRHP.
AECOM 2014	Georgia Archaeological Site Form for Historic Resource Property E	Property E	Documentation of Archaeological Aspect of Property E. Recommended Ineligible for NRHP.
AECOM 2014	Georgia Archaeological Site Files Search	Glades Reservoir and Transmission Line to Lakeside WTP	Four previously conducted cultural resources surveys in these areas. Seven architectural history resources identified within the APE of the Proposed Project with unknown eligibility; 1 archaeological site with unknown eligibility.
AECOM 2015	Glade Farm Boundary Justification	Glade Farm	250-acre boundary recommended as NRHP-eligible boundary
AECOM 2014	Mose Gordon Lumber Co. Mess Hall PIF	Structure and boundary	Recommended Eligible for NRHP
AECOM 2014	Resource 2	Chicken Houses	Recommended Ineligible for NRHP

Archaeological Resources in the Glades Reservoir APE

One archaeological field survey was conducted at the Glades Reservoir site (Price 2002, **Appendix T**). A total of 18 archaeological sites and 14 isolated finds were discovered during the 850-acre archaeological survey. Results of that survey are presented in **Table 3.64** and **Table 3.65**.

Table 3.64 Glades Reservoir APE: Archaeological Sites

ID Number (Trinomial)	Name	Historic/ Prehistoric	Period	Type	Condition	NRHP Eligibility
9HL462	3	Prehistoric	Unknown	Plowzone/ Subsurface	Less than 50% disturbed	Potentially Eligible
9HL478	27	Prehistoric	Unknown	Plowzone/ Subsurface	Less than 50% disturbed	Potentially Eligible

Table 3.65 Isolated Archaeological Finds within the Glades Reservoir APE

No.	Type	Recommendation
1	Woodland	Additional work recommended
3	Woodland	Additional work recommended
11	Lithic only	Additional work recommended
13	Woodland	Additional work recommended

Of the archaeological sites, only two (9HL462 and 9HL478) were recommended potentially eligible for listing on the NRHP and recommended for Phase II testing; the SHPO concurred on August 26, 2009 (**Appendix T**). Site 9HL462 is a well-preserved prehistoric site located on a slight rise in the floodplain along Flat Creek. At this location, 248 artifacts were recovered from 17 shovel tests. Site 9HL478 is located on the lower portion of a ridge that projects into the floodplain of Flat Creek. Artifacts were recovered from ten shovel tests and three backhoe trenches. Subsequent backhoe trenches in the floodplain revealed a thick deposit of historic alluvium overlying the southwestern end of the site and extending in a narrow strip southwest towards Flat Creek. Therefore, this site may extend into the floodplain to the border of Flat Creek, where the prehistoric land surface is sealed beneath a layer of historic sediment 24 to 40 inches thick.

In addition to the two potentially eligible archaeological resources, multiple areas within the floodplain of Flat Creek were identified during the field surveys as archaeologically sensitive, with high potential for intact, buried prehistoric deposits. Four of these areas correspond with Isolated Finds (#1, 3, 11, and 13) of archaeological materials. These areas occur in a portion of Flat Creek floodplain where historic sedimentation associated with gold mining has buried stable prehistoric surfaces.

Phase II testing was recommended to evaluate the NRHP eligibility of sites 9HL462 and 9HL478 (Price, 2002, **Appendix T**). It was also recommended that trenching/stripping of the historic overburden in the archaeologically sensitive areas, occur to examine the underlying surface for archaeological sites. The SHPO concurred in a letter dated August 26, 2009 that Phase II testing is warranted at each site and with the recommendation that deep testing is warranted at Isolated Finds #1, 3, 11, and 13 (see **Appendix T**).

Historic properties in the APE

The 2002 cultural resources survey of Glades Reservoir identified five historic properties within the Glades Reservoir APE, as described above (**Table 3.64**) (**Appendix T**). The properties were designated Properties A through E; only one of them, Property A, was recommended eligible for the NRHP. The SHPO (2009, **Appendix T**) concurred that Property B (bungalow dating from the mid-1930s), Property C (bungalow dating from the mid-1930s), and Property D (chicken house dating from the early 1950s), do not appear eligible for the NRHP. As a result of coordination with the SHPO (**Appendix T**), requests to reassess the Glades Reservoir APE for properties that may have come of age since the time of the 2002 cultural resources survey and additional information regarding Property E were made.

Property A – Glade Farm House

On August 26, 2009, the SHPO concurred with the finding that the Glade Farm property (Property A) is eligible for listing in the NRHP under Criterion A for its association with local agricultural history and settlement. The Glade Farm House (ca. 1835) is also eligible under Criterion C, as a significant Georgia house style (Georgian House). The house may also be eligible under Criterion B for its association with its early owners (**Appendix T**).

The SHPO (2009) (**Appendix T**) recommended that additional analysis be performed to identify contributing characteristics of the Glade Farm property to better understand the reservoir's effects on the property. The SHPO also suggested that a historic landscape assessment of the property should be conducted that would potentially identify boundary demarcations, spatial organization patterns, circulation networks, and the identification of extant agricultural fields. It was also noted that indirect effects from the project should also be considered. The SHPO concluded that the Glades Reservoir project, as currently proposed, would have an adverse effect on the NRHP-eligible Glade Farm property.

To support the requests for additional information, a letter and Historic Structures & Landscape Sight Lines report (**Appendix T**) were submitted to SHPO on March 31, 2014. As a result of this coordination, a request was made for additional support for Glade Farm boundary justification during the period of significance.

In 2015, the SHPO (2015, **Appendix T**) concurred with a 250-acre boundary for Glade Farm House. The Glade Farm boundary justification consists of the original 250-acre land lot 100 from the 1820 land lottery upon which the Glade Farm House sits (**Appendix T**). Coordination with the SHPO is ongoing regarding the Assessments of Effect and Programmatic Agreement.

Historic Structures Identified within the Glades Reservoir APE in 2014

Per SHPO coordination (**Appendix T**), a reassessment was made of the APE to identify structures 50 years old or older (**Table 3.66**). As a result of these efforts, two new properties were identified and evaluated under Section 106 criteria in the PIFs (**Appendix T)**. These include the Mose Gordon Lumber Company Mess Hall, which was recommended as eligible for the NRHP, and Resource 2, chicken houses, recommended ineligible for the NRHP.

Mose Gordon Lumber Company Mess Hall

The Mose Gordon Lumber Company Mess Hall is a single-story, H-plan, frame building on a brick foundation with concrete block patches. The SHPO concurred with its eligibility on March 25, 2015 (**Appendix T**).

Table 3.66 Historic Structures within Glades Reservoir APE[1]

No.	Resource ID	Resource Type	Historic Use	Construction Date	Style	NRHP Eligibility	Survey Date
1	Glade Farm House (Property A)	Farm House and associated 250-acre property	Farm	1835	Georgian	Eligible	2002
2	Property B	Small frame house	Dwelling	mid-1930s	Bungalow	Not Eligible	2002
3	Property C	Small frame house with outbuilding	Dwelling	mid-1930s	Bungalow	Not Eligible	2002
4	Property D	Chicken house	Housed chickens	early 1950s	N/A	Not Eligible	2002
5a	Property E *Structure 1*	Gordon Lumber Co. Frames Structures Complex	Unknown	early 1940s	Barrack-like building	Not Eligible	2002, 2014 (re-evaluated as archaeological resource)
5b	Property E *Structure 2*	Gordon Lumber Co. Frames Structures Complex	Unknown	early 1940s	Barrack-like building	Not Eligible	2002, 2014 (re-evaluated as archaeological resource)
5c	Property E *Structure 3*	Gordon Lumber Co. Frames Structures Complex	Unknown	early 1940s	Small-single room building	Not Eligible	2002, 2014 (re-evaluated as archaeological resource)
4d	Property E *Structure 4*	Gordon Lumber Co. Frame Structures Complex	Unknown	early 1940s	Two or possibly three separate frame buildings that have been incorporated together for use as a dwelling	Not Eligible	2002, 2014 (re-evaluated as archaeological resource)
6	Mose Gordon Lumber Co. Mess Hall	Mess Hall	Industry	1947	Double pen house with No Academic Style	Eligible	2014
7	Resource 2	Chicken Houses (2)	Housed Chickens	early 1960s	Commercial	Not Eligible	2014

Notes:
[1] All resources were recorded by Price (2002) for the 404 Permit Application; the 2014 review of SHPO files and Georgia Natural, Archaeological, and Historic Resources GIS (GNAHRGIS) for the current undertaking found that no additional NRHP properties have been recorded in the Glades Reservoir APE since 2002. An evaluation of properties 50 years old or older within the APE resulted in the identification of two new properties evaluated under Section 106 criteria in 2014. Detailed information of all resources evaluated is provided in **Appendix T**.

Summary of Cultural Resources in the Glades Reservoir APE, Glades Reservoir Alternative

Within the Glades Reservoir Alternative APE, there are two potentially eligible archaeological sites for NRHP listing, 14 are not NRHP-eligible, and an additional two sites are of unknown NRHP eligibility. In addition, there are four isolated finds that require additional testing and are therefore considered potentially eligible for NRHP listing. There are seven historic properties located in the Glades Reservoir Alternative APE. Of these properties, two are recommended eligible for the NRHP, including the Glade

Farm property and the Mose Gordon Lumber Company Mess Hall. **Figure 3.47** shows the boundaries of the NRHP-recommended eligible properties.

3.12.2.2 White Creek Reservoir Alternatives

No previous cultural resources field surveys have been conducted in the potential White Creek Reservoir site. No field surveys were conducted within this APE; however, GNAHRGIS and the Georgia Archaeological Site File search were used as databases for this research. If the White Creek Alternative is selected to advance for further consideration as an alternative, then field surveys for historic architectural buildings and archaeological resources will be conducted. At that time, Section 106 consultation will be initiated and coordination will occur with the SHPO.

Archaeological Resources in the White Creek Reservoir APE

Background research was conducted using the Georgia Archaeological Site File search. This review indicated that no previously recorded prehistoric or historic archaeological sites are located within the White Creek Reservoir APE.

Historic Properties in the White Creek Reservoir APE

Background research using the Georgia Archaeological Site File search and GNAHRGIS indicated no architectural resources are located within the White Creek Reservoir APE.

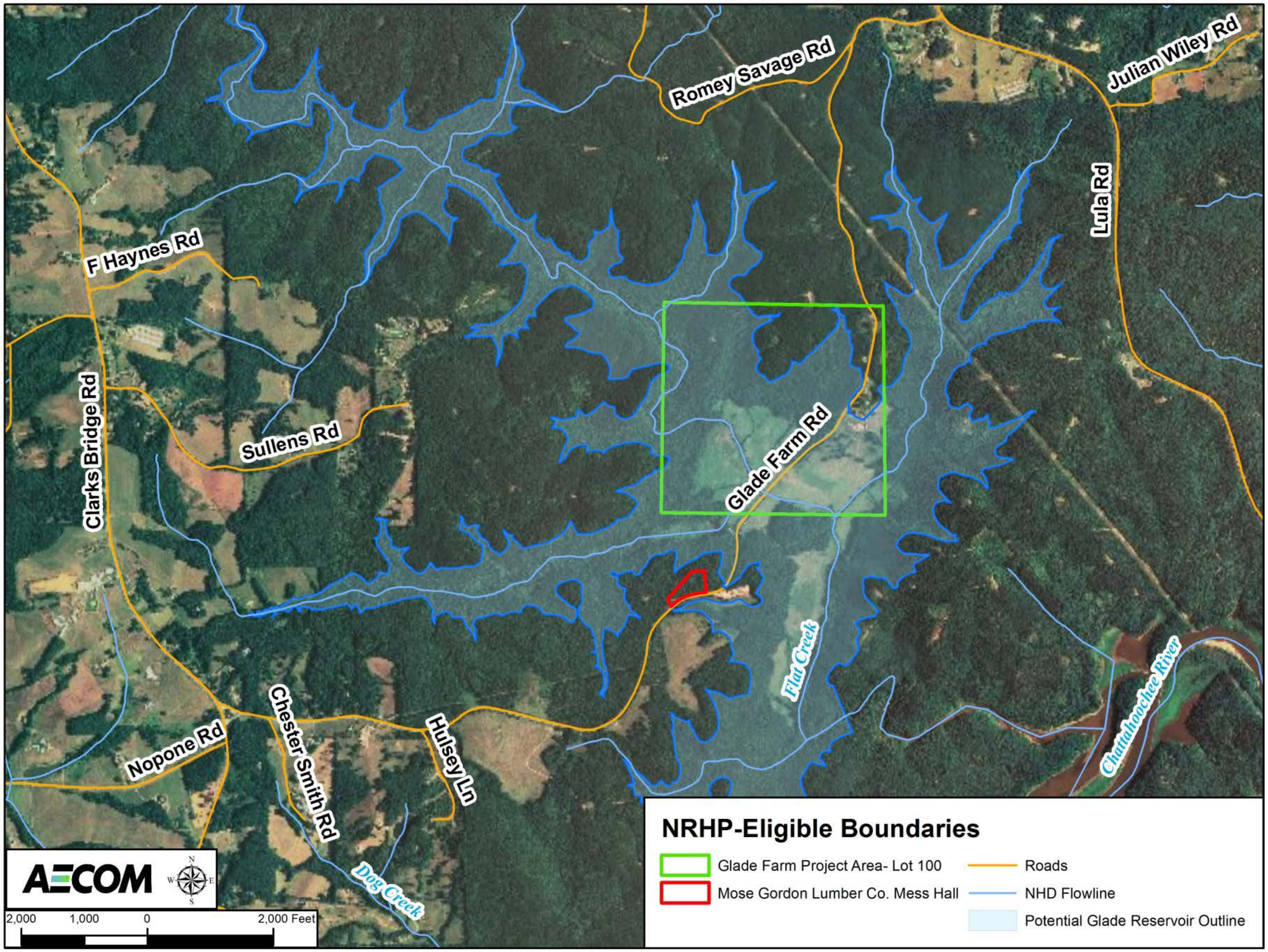
Summary of Cultural Resources in the White Creek Reservoir APE

Background research indicated no NRHP-eligible or listed resources have been identified within the White Creek Reservoir APE.

3.12.2.3 Glades Reservoir and White Creek Reservoir Transmission Systems

Two approaches to identifying cultural resources were used for the Glades Reservoir and White Creek Reservoir Transmission Systems APEs, including background research of previous investigations and Georgia SHPO, Georgia Site Files. No field surveys were conducted within this APE; however, GNAHRGIS and the Georgia Archaeological Site File search were used as databases for this research. If the White Creek Alternative is selected to advance for further consideration as an alternative, then field surveys for historic architectural buildings and archaeological resources will be conducted. At that time, Section 106 consultation will be initiated and coordination will occur with the SHPO.

Figure 3.48 Boundaries for NRHP-Eligible Properties within Glades Reservoir APE



Previous Investigations

Background research indicated four previously conducted cultural resources surveys that cross into the southern end of the transmission main and pump stations area (**Table 3.67**). Although two non-NRHP eligible archaeological sites were reported in the 1999 survey of the proposed Chicopee Woods Golf Course Extension (9HL438; 9HL439), neither site is within the current project APE. No cultural resources were identified by three other surveys, and no further work was recommended as a result of any of the surveys. Additional details about archaeological and historical reviews are provided below.

Table 3.67 Transmission Main & Pumping Stations: Previous Investigations

Author & Year	Report Title	Area	Findings	Recommendations
Cantley 1999	Phase I Archaeological Survey of Chicopee Woods Golf Course Extension, Hall County, Georgia	Chicopee Woods Golf Course, 1.75 miles NE of SR 53 and I-985 intersection	One prehistoric site and one historic site (outside the APE for Proposed Project).	No further work recommended.
Cremer et al. 2007	A Phase I archaeological Assessment of the Falcons Interchange (I-985), Hall County, Georgia	Falcons Interchange, near intersection of I-985 and Falcons Parkway	No archaeological resources were identified.	No further work recommended.
Mustonen 2009	Archaeological Survey of GDOT Project Surplus Property along I-985 and SR 53, Hall County, Georgia	I-985 and SR 53, intersection of SR 53 and I-985	No archaeological resources were identified.	No further work recommended.
Wynn 2012	Archaeological Surveys at Elachee Nature Science Center, Gainesville, Georgia	Chicopee Woods Nature Preserve, 2 miles NE of SR 53 and I-985 intersection	General identification and documentation.	No recommendations.

Archaeological Resources in the Glades Reservoir and White Creek Reservoir Transmission Systems APE

A review of the GNAHRGIS, Georgia Archaeological Site File, and Georgia SHPO files was conducted. This review indicated that one previously recorded prehistoric site was identified at the southernmost portion of the transmission main (**Table 3.68**). The site (9HL445) is a highly disturbed prehistoric lithic scatter located on a ridge nose in Hall County.

Table 3.68 Transmission Lines & Pumping Stations: Archaeological Sites within the APE

ID Number (Trinomial)	Name	Historic/ Prehistoric	Period	Type	Condition	NR Eligibility
9HL445	FS-1A	Prehistoric	Unknown	Lithic Scatter	Disturbed	Unknown

Historic Architectural Resources in the Glades Reservoir and White Creek Reservoir Transmission Systems APE

A total of seven historic properties have been documented within the Glades Reservoir and White Creek Reservoir Transmission Systems APE (**Table 3.69**). These resources include four single-family dwellings and three church-cemeteries. The four single-family dwellings were constructed between 1889 and 1932. Their eligibility for inclusion on the NRHP is currently undetermined. The three churches with cemeteries all date between 1850 and 1894. The oldest of these is the Clemons Chapel United

Methodist Church Cemetery, which is located in a rural environment and was begun in 1850. The cemetery has approximately 200 graves, which include both marked gravestones (earliest dated 1850) and unmarked fieldstones.

Table 3.69 Historic Properties within Glades Reservoir and White Creek Reservoir Transmission Systems APE[1]

Resource ID	Resource Type	Historic Use	Construction Date	Style	NRHP Eligibility	Area	Survey Date
38580	One-story single-family house (Bungalow)	Single Dwelling	1932	No academic style	Undetermined	Alts. 3 & 4 Transmission Line	1/1/1993
38581	One-story single-family house (Bungalow)	Single Dwelling	1932	No academic style	Undetermined	Alt. 4 Transmission Line	1/1/1993
38924	One-story single-family house	Single Dwelling	1909	No academic style	Undetermined	Alt. 3 Transmission Line	1/1/1993
38989	One-story single-family house	Single Dwelling	1889	No academic style	Undetermined	Alt. 4 Transmission Line	1/1/1993
214534	Clemons Chapel United Methodist Church Cemetery (200 graves)	Cemetery	1850	No academic style	Undetermined	Alt. 1 Transmission Line	1/1/2008
214869	HL-80 Pleasant Hill Church Cemetery (250 graves)	Cemetery	1860	No academic style	Undetermined	Alts. 3 & 4 Transmission Line	1/1/2008
215008	HL-81 Living Mission United Methodist Church and Cemetery	Cemetery	1894	No Academic Style	Undetermined	Alt. 2 Transmission Line	1/1/2008

Note: [1] Data collected from GNAHRGIS

Cultural Resources in the Reservoir Water Transmission Systems APE

One archaeological site and seven historic properties have been recorded within the Glades Reservoir and White Creek Reservoir Transmission Systems APE. The archaeological site lies at the southernmost end of the transmission main and is a lithic scatter, which has been highly disturbed. The NRHP eligibility of the resource is unknown. The seven architectural resources documented within the APE include three historic cemeteries and four single-family dwellings; the NRHP eligibility of these resources has not been determined.

3.12.3 Summary

Within the Glades Reservoir APE, two historic properties (Glade Farm House and Mose Gordon Lumber Company Mess Hall) are identified as eligible for the NRHP. Within the Glades Reservoir APE, two archaeological sites are potentially eligible for NRHP listing, 14 are not NRHP-eligible, and two have unknown eligibility status. Four of the archaeological isolated finds require additional testing; therefore, NRHP status is considered potentially eligible.

Within the White Creek Reservoir APE, no NRHP-eligible or listed resources were identified.

Within the Glades and White Creek Reservoir APE, there are seven historic architectural resources and one archaeological resource, none of which have been evaluated for inclusion on the NRHP.

Table 3.70 presents the eligibility status of those resources.

Table 3.70 Resource Summary Table

	Historic Property Resources				Archaeological Resources				
Alternative	NRHP-Eligible	Not Eligible	Undetermined	Totals	NRHP-Eligible	Not Eligible	Potentially Eligible	Unknown	Totals
Glades Reservoir APE	2	5	0	7	0	26	21	42	32
White Creek Reservoir APE	0	0	0	0	0	0	0	0	0
Glades and White Creek Transmission Systems APE	0	0	7	7	0	0	0	1	1
Totals	2	5	7	14	0	24	6	3	33

[1] These sites recommended for a Phase II investigation
[2] These sites recommended for additional testing

3.13 Native Americans

Native American cultures preceding English settlement expansion included the Cherokee and Creek. In general, the Cherokee groups occupied northern Georgia and the Creek occupied southern Georgia. According to “Cultural Resources Survey of the Proposed 850-Acre Glades Reservoir on Flat Creek, Hall County, Georgia (Price, 2002)” on file at SHPO, the border between the Creek Confederacy and the Cherokee Nation roughly extended between Athens and Lawrenceville and west through Marietta. The Cherokee peoples were living in Hall County up until 1817, when Hall County was formed through acquisition of their territory and the land lottery. The Cherokee people were forced to move in 1838 by the federal government. There are no tribal lands within the vicinity of the affected area of the alternatives carried forward for further evaluation.

3.14 Hazardous Materials

Hazardous waste and materials are substances or materials that could adversely affect the safety of the public or environment if released. Facilities that handle, generate, or store hazardous waste or hazardous materials are regulated by a local, state, or federal agency. A desktop survey was conducted for hazardous waste facilities, hazardous materials facilities, or known hazardous waste sites located within 500 feet of the proposed reservoir sites and their associated pipelines and transmission mains. The survey was completed using EPA Envirofacts, Resource Conservation and Recovery Act and Comprehensive Environmental Response, Compensation, and Liability Act sites, and EPA Enforcement and Compliance History Online (ECHO). In addition to the search for hazardous waste facilities, hazardous materials facilities, and known hazardous waste sites, the possible presence of hazardous materials was also taken into consideration based on field surveys conducted for proposed displacements. Based on the online desktop survey, no hazardous waste or hazardous materials facilities and no known hazardous waste sites were identified within the 500-foot radius of the affected area of the alternatives carried forward for further evaluation.

Field surveys conducted for the Glades Reservoir and the White Creek Reservoir site areas noted several structures located within each proposed site area. Depending on the age of the structures (pre-1979), asbestos-containing material may be a concern if any demolition or construction activities are to be performed on the structures. In addition, polychlorinated biphenyl (PCB)-containing dielectric fluids and lead-based paint are concerns for structures constructed prior to 1979.